Impact of Parenting Stress on Parents' Use of ASD Intervention Strategies

Hannah Benavidez

A thesis

submitted in partial fulfillment of the

requirements for the degree of

Master of Science

University of Washington

2022

Committee:

Wendy Stone

Shannon Dorsey

Program Authorized to Offer Degree:

Psychology

University of Washington

Abstract

Impact of Parenting Stress on Parents' Use of ASD Intervention Strategies

Hannah Benavidez

Chair of the Supervisory Committee:

Wendy Stone

Department of Psychology

Parent-mediated interventions (PMI) for toddlers with Autism Spectrum Disorder (ASD) are becoming increasingly more common due to their cost effectiveness and opportunities for skills generalization. Parent intervention fidelity is critical for child outcomes in PMI; however, little is known about which parent characteristics may impact parent intervention fidelity. Parenting stress may be an important first factor to explore as it has been well documented that parenting stress is higher in parents of children with ASD, and it has close links to other important factors including socio-economic status and overall parent well-being. This study, using 49 parents of children at elevated risk for developing ASD (i.e., have an older sibling with an ASD diagnosis), sought to examine if parenting stress impacted one component of parent intervention fidelity, namely parents' use of intervention strategies, following participation in a parent-mediated intervention. Regression analyses revealed no significant impact of parenting stress on parents'

use of intervention strategies. Potential reasons that a significant relation was not found are discussed. Given the increased shift towards PMI, research should continue to examine how the role of parent characteristics interact with parent intervention fidelity so we can understand how to best serve parents as they support their children, through parent-mediated interventions.

Autism Spectrum Disorder (ASD) is a pervasive neurodevelopmental disorder that is characterized by impaired social communication and the presence of restricted and repetitive behaviors and/or interests (Maenner et al., 2020). Rates of ASD have increased over the last few decades to affect 1 in 54 children in the U.S. (American Psychiatric Association, 2013). A substantial body of literature supports early intervention as vital for improved language, social, behavioral, and cognitive functioning in young children with ASD (Dawson et al., 2010; Ingersoll, 2010; Kasari et al., 2015; Landa et al., 2011 Zwaigenbaum et al., 2015). Recent research has focused on improving the efficacy and effectiveness of early ASD-specialized intervention. Early diagnosis of ASD is important because family's access to early ASD-specialized intervention is often predicated on a formal diagnosis, however, there are various challenges to diagnosing toddlers before the age of 3 years. As such, familial risk populations represent a unique sample in which to assess the efficacy of interventions for toddlers under 3 years because there is a strong genetic component of ASD with recent heritability estimates ranging between 50-90% (Hallmayer et al., 2011; Tick et al., 2016). Indeed, 19% of younger siblings of children with ASD (HR-Sibs) receive an ASD diagnosis by 36 months and another 40% demonstrate broad autism phenotype (BAP) or other developmental delays (Charman et al., 2016; Green et al., 2017; Ozonoff et al., 2011).

Interventions for Young Children with ASD

Because young children with ASD experience difficulties in social interaction and communication, most ASD-specialized interventions focus on improving these areas. Naturalistic Developmental Behavioral Interventions (NDBIs) represent a new class of specialized interventions for young children with ASD (Schreibman et al., 2015). There is growing support for NDBIs as best practice for treatment of children with and at risk for

developing ASD as they combine both Applied Behavior Analysis (ABA) and developmental science approaches within a naturalistic context (National Research Council, 2001; Zwaigenbaum et al., 2015). NDBIs focus on the use of child-directed strategies to target a variety of domains including cognitive, language, play, social, and imitative skills. This approach highlights the importance of integration of learning across domains such that skills are not taught in isolation, but rather within the context of typical daily routines or interactions outside of a single treatment setting. Some examples of current NDBIs include Reciprocal Imitation Training (RIT; Ingersoll, 2010), Joint Attention Symbolic Play Engagement and Regulation (JASPER; Kasari et al., 2010), the Early Start Denver Model (ESDM; Dawson et al., 2010), Pivotal Response Training (PRT; Koegel & Koegel, 2006), and Improving Parents As Communication Teachers (Project ImPACT; Ingersoll & Dvortcsak, 2010; Ingersoll & Wainer, 2013), the intervention of interest in the present study. NDBIs often employ a parent-mediated approach, wherein qualified clinicians teach parents directly how to implement intervention strategies with their children for use at home and in the community (Schreibman et al., 2015).

Parent mediated interventions (PMI) for young children with ASD have become increasingly common over the last decade as there is emerging evidence that supports positive gains in child outcomes (Nevill et al., 2018). Parent-mediated NDBIs, more specifically, have led to improvements in child social behaviors (e.g., joint engagement, imitation) and verbal communication (Bradshaw et al., 2017; Kasari et al., 2015; Wetherby et al., 2014). In addition to evidentiary support for PMIs, there is strong theoretical and practical rationale that has led to calls for further research. The PMI model may have great benefits as it maximizes active treatment engagement across contexts including daily routines such as bedtime and mealtime as well as play time (Roberts & Kaiser, 2011; Yoder et al., 2021). Implementing and practicing

intervention strategies throughout daily routines may be essential to achieving generalization and maintaining treatment gains as it increases children's exposure to the treatment in different settings (Brookman-Frazee et al., 2009; Wetherby & Woods, 2008). Furthermore, the World Health Organization emphasizes significant benefits regarding time and cost demands as parents can deliver treatment to their children outside of time spent with an intervention provider without overburdening the service system (World Health Organization, 2016). Although the burden on the service system may lessen with PMI, there is some debate about whether more burden falls on parents, who already face many caregiving challenges, with the additional responsibility of being their child's intervention provider. Current research, however, has found a positive effect of PMI on parenting-related stress, empowerment, and perceived self-efficacy (Ingersoll et al., 2016; Kasari et al., 2015; Minjarez et al., 2012; Watson et al., 2017). Within ASD intervention research, it is important to consider, not only the child, but also the broader family unit.

ASD and Parenting-Related Stress

ASD impacts many areas of a child's life and can have ramifications for other members of the family, especially parents. The behavioral characteristics of ASD such as challenges with social behaviors, difficulties with functional communication, and rigidity around routines and play can pose a challenge to caregivers as they navigate through everyday life. One consequence of these ASD-related challenges is that many parents of children with ASD have been found to experience elevated levels of parenting-related stress relative to parents of children with other developmental disabilities and those with typical development (for a review, see Hayes & Watson, 2013). Parenting-related stress is a specific kind of stress that arises from attempts to adapt to the demands of parenthood and is thought to result from a combination of characteristics of the child, the parent, and the context (Deater-Deckard, 1998). Unlike general stress, for which

there is believed to be a U-shaped curve with an optimal level of stress associated with peak performance (Salehi et al., 2010), parenting-related stress has cumulative effects which can be detrimental, especially to the parent-child relationship (Abidin, 1997; Deater-Deckard, 1998).

Research with families of children with ASD has found that parenting-related stress is strongly associated with child behavior and functioning. Various studies have found that higher ASD severity is related to higher levels of parenting-related stress (Davis & Carter, 2008; Gabriels et al., 2005; Kasari & Sigman, 1997; Rodriguez et al., 2019). For example, Davis and Carter found that elevated levels of parenting-related stress were associated with lower ratings of children's social relatedness. If we think about ASD conceptually, given that children with ASD exhibit core deficits in social skills and communication, parents of children with ASD may experience unique challenges around interacting and bonding with their children that can contribute to increases in parenting-related stress (Hall & Graff, 2011).

In addition to core social and communication challenges, children with ASD may also present with co-occurring including language delays, disruptive behavior, anxiety, attention difficulties, and intellectual disability (Mannion & Leader, 2013; Webb & Jones, 2009). Beyond ASD symptoms, lower levels of adaptive and cognitive functioning in the child have also been shown to predict higher levels of parenting-related stress (Craig et al., 2016; Hall & Graff, 2011). For example, parents of children with ASD face a multitude of time and energy-draining hurdles as their children need increased support to accomplish everyday tasks such as brushing their teeth or putting on their shoes (Hall & Graff, 2011; Plant & Sanders, 2007). Furthermore, as children with ASD may also exhibit co-occurring externalizing behavior, there may be increased interferences with daily routines and activities that could impact parenting-related stress (McStay, Trembath, et al., 2014; Plant & Sanders, 2007). Indeed, child behavior problems have

been found to be a strong predictor of parenting-related stress in a number of studies (Blacher & McIntyre, 2006; Firth & Dryer, 2013; Hastings et al., 2005; Lecavalier et al., 2006; McStay, Trembath, et al., 2014; McStay, Dissanayake, et al., 2014; Peters-Scheffer et al., 2012).

Additionally, the road to obtaining an ASD diagnosis and receiving appropriate services can be lengthy, confusing, and stressful for parents (Gordon-Lipkin et al., 2016; Moh & Magiati, 2012; Zwaigenbaum & Maguire, 2019). Although ASD diagnoses can be made as early as 14 to 18 months by specialists (Ozonoff et al., 2015; Pierce et al., 2019) the average age of an ASD diagnosis in the U.S. is much later at 4.25 years (Maenner et al., 2020), resulting in up to 2-year delays from first concerns to receipt of a formal ASD diagnosis (Gordon-Lipkin et al., 2016; Sansosti et al., 2012). Parents face multiple barriers in trying to advocate for their children for whom they have developmental concerns, including passive/dismissive responses from primary care providers, low rates of screening and appropriate diagnostic referrals in primary care settings, a general lack of provider training in early ASD features, discomfort in addressing ASD concerns with parents, limited availability of diagnostic service providers, and subsequent long waitlists for diagnostic evaluations (Arunyanart et al., 2012; Carbone et al., 2013; Crais et al., 2014; Martinez et al., 2018; Tomlin et al., 2013; Zuckerman et al., 2015). Consequently, due to these challenges with early diagnosis of ASD, many children may fail to receive ASD specialized services before the age of 3 years (a time of rapid, critical brain development) which can be a difficult burden to parents. Indeed, these obstacles not only impede timely diagnoses, but parents report feelings of uncertainty and helplessness during this stressful time (Moh & Magiati, 2012; Mulligan et al., 2012). Importantly, recent research has found that even before receiving a diagnosis, parents who are concerned about ASD for their children are reporting higher levels of parenting-related stress as compared to parents with other developmental

concerns for their children. (DesChamps et al., 2019). Additionally, once there is a receipt of an ASD diagnosis, parents must choose and access ASD-specialized intervention. However, there is a plethora of ambiguous and misleading recommendations for ASD-specialized treatment on the internet that can overwhelm parents about choosing an appropriate approach (Matson et al., 2013; Mire et al., 2017).

High levels of parenting-related stress have been associated with detrimental long-term effects on physical and mental adjustment for parents of children with ASD (Deater-Deckard, 1998, 2004; Neece et al., 2012). For example, higher levels of parenting-related stress have been strongly linked to increases in parent depressive and anxiety symptoms and decreases in parent psychological well-being in parents of children with ASD (Charman et al., 2016; Phetrasuwan & Miles, 2009; Rezendes & Scarpa, 2011; Salomone et al., 2018; Singer, 2006) as well as higher rates of divorce (Hartley et al., 2010). A recent longitudinal study found a bidirectional relationship between parenting-related stress and child ASD symptom severity using a multi-group cross-lagged panel design, such that ASD symptom severity earlier in the study drove increases in parenting-related stress, which in turn positively predicted children's ASD symptoms later in the study (Rodriguez et al., 2019). Thus, the interaction between parent and child behavior is important to consider, especially within the context of parent-mediated intervention.

Parenting-Related Stress and PMI

Despite the accumulating evidence in favor of PMI for both children and parents and the extant literature on higher levels of parenting-related stress in the ASD population, only recently has research begun to examine the impact of parenting-related stress on children's treatment outcomes. A recent systematic review of the role of parent characteristics in PMI for young

children with ASD revealed limited and mixed findings (Shalev et al., 2019). For example, Watson and colleagues (2017) found that lower levels of parenting-related stress predicted greater gains in IQ (specifically visual reception skills) post-intervention whereas Rickards et al. (2007) revealed that higher parenting-related stress was associated with children's positive gains in cognitive development. Additionally, Stadnick et al. (2015) found that higher levels of parenting-related stress at baseline predicted poorer outcomes in social functioning following participation in Project ImPACT. Yet another study revealed mixed findings in that higher baseline parenting-related stress was associated with better language scores, but poorer adaptive skills posttreatment (Strauss et al., 2012). Overall, although it may be unclear whether the effects of parenting-related stress on child treatment outcomes within PMI are deleterious or positive, it seems that parenting-related stress has a negative impact on outcomes directly related to ASD symptomology (e.g., language and social skills). This an important distinction to make because, as mentioned earlier, many PMI focus on teaching parents how to improve core ASD challenges (i.e., social communication and language difficulties).

Parenting-Related Stress and Parent Intervention Fidelity

Further investigation into the way in which parent intervention fidelity is associated with parenting-related stress may provide elucidation into the above conflicting findings. Intervention fidelity refers to the extent to which core components of interventions are delivered as intended by the protocol (Gearing et al., 2011; Gitlin & Parisi, 2016). There are various components of intervention fidelity, including treatment adherence, exposure/dosage, and quality of delivery. This study will focus on treatment adherence, which Caroll et al. (2007) describes as the core of intervention fidelity. Multiple studies focused on ASD-specialized PMI have found that treatment adherence directly impacts child treatment outcomes (Fava et al., 2011; Gulsrud et al.,

2016; Ingersoll & Wainer, 2013; Vismara et al., 2009; Yoder et al., 2021). Several studies have found that observed use of intervention strategies (one type of measurement of treatment adherence) is associated with improved child outcomes in PMI (Fava et al., 2011; Visamara et al., 2009; Yoder et al., 2021). Ingersoll & Wainer (2013) found that parents' increased use of intervention techniques explained unique variance in child spontaneous language following participation in Project ImPACT. Similarly, Gulsrud et al. (2016) reported that parents' use of strategies was related to children's joint engagement and explained almost 30% of the variance following JASPER. Additionally, in this paper's formative study, the researchers examined the "cascading model of intervention delivery" (Yoder et al., 2021). Specifically, the study found that parents' observed use of intervention strategies mediated the relation between group assignment (treatment or control) and child communication abilities (see Yoder, Stone, & Edmunds, 2021 for comprehensive findings). Increased levels of parenting-related stress may monopolize resources that are needed for implementing an intervention effectively. On the other hand, it is possible that parents with higher levels of parenting-related stress are seeking increased support and are more likely to engage in the intervention effectively.

To date, there are few studies that have examined the relation between parenting-related stress and treatment adherence in the ASD literature. Carr et al. (2016) found that higher parenting-related stress predicted better self-reported treatment adherence in a community sample that was low-resourced (see Carr et al., 2016 for a description of low-resourced). In contrast, Rollins and colleagues (2019) found that initial parenting-related stress negatively affected parental responsivity (i.e., a fundamental target of interactional strategies) only in those parents who participated in treatment as usual (versus PMI). ASD literature examining the relationship between other parent characteristics and parent intervention fidelity is also quite

limited and mixed. One study found that lower socioeconomic status predicted poorer treatment attendance (Carr et al., 2016) while another study reported no relationship between parent education and parents' use of intervention strategies (Brian et al., 2017). Additionally, Hock et al. (2015) revealed perceptions of treatment burden was found to predict lower self-reported treatment adherence.

Study Aims

This study aims to fill the gap in ASD literature regarding the relationship between parenting-related stress and treatment adherence. Parenting-related stress is the focus of this study as parenting-related stress has strong associations with the parent-child relationship, which can influence the interactional strategies often used in PMI. Understanding the relationship between parenting-related stress and treatment adherence could be crucial in learning how to best support parents in their role as treatment provider. As the field continues to move towards PMI, it is critical that parents are set up for success in delivering treatment for their children with ASD. Considering the close relationship between treatment adherence and child outcomes, its vital that we investigate factors that can be detrimental to parent's involvement and possibly impede children's progress in PMI.

The overall goal of this study is to examine whether parenting-related stress at the start of treatment impacts parents' use of intervention strategies following participation in a PMI for HR-sibs. I hypothesize that parents with higher levels of parenting-related stress will show less use of intervention strategies following training, compared to parents with lower parenting-related stress. Thus, I am operating under the theory that higher levels of parenting-related stress may impact the resources that parents need to effectively deliver the intervention strategies.

Method

Participants

A total of 49 primary parents of toddlers at familial risk for ASD were included in the present study. All participants were recruited as part of a larger intervention study examining the effects of a parent-mediated NDBI on child social communication challenges at two sites (Nashville n=25, Seattle n=24). Eligibility criteria for families were: (a) at least one older child with a confirmed ASD diagnosis in the home; (b) a younger full or half sibling between 12 and 18 months at study entry; and (c) English as the primary language spoken at home. Exclusion criteria included: (a) the younger sibling born at less than 32 weeks gestational age; (b) any known neurological or genetic conditions in the younger sibling; and (c) any severe uncorrected vision or hearing impairments in the younger sibling. Ninety-seven (97) children and their primary parent participated in the larger study and were randomized via computerized balancing into either the ImPACT (intervention) group or a treatment as usual (control) group. For the purposes of the current study, only data from families in the intervention group were used. Demographic data for the sample can be found in Table 1. All families were consented and the study was approved by the applicable Institutional Review Boards (IRB).

Procedure

After parent-child dyads were randomized to either the intervention or control groups, they were seen at four timepoints: before intervention (Time 1), immediately after the 3-month intervention (Time 2), 6 months after study entry (Time 3), and nine months after study entry (Time 4). Parents' use of intervention strategies was only collected at Time 1 (pre-intervention) and Time 2 (3 months post-intervention), so only these two measurement periods were included

in the present study. Study assessors and coders of observational procedures were masked to intervention group assignment.

Intervention

The ImPACT intervention, given to all participants in the present study, was a 12 week in home program given by a staff member at each site (Nashville and Seattle). It consisted of up to 24 teaching sessions in which a trained staff member sequentially taught intervention techniques focused on setting up joint interaction routines around toys and objects that enable modeling and direct teaching of play, communication, and language. Each session consisted of introducing and discussing a new intervention strategy, modeling the strategy with the child, and then having the parent practice the technique with the child while the staff member provided positive and corrective feedback. As a homework plan for each week, parents were asked to provide at least one hour of therapy per day for five days/week, which could be dispersed across the day. The ImPACT intervention is described in more detail in the first edition of the comprehensive manual (Ingersoll & Dvortcsak, 2010). The staff member at the Nashville site was a speech-language pathologist (SLP) who had been trained and certified by the developers of Project ImPACT who then trained a staff member at the Seattle site. To measure trainer implementation fidelity, the two staff members completed session-specific checklists on at least two sessions per parent–child dyad. Adherence to the Project ImPACT protocol for teaching parents averaged 91% (SD=3%, range: 85-99%). Of the parents in the present study, 86% completed the program content in its entirety.

Measures/Assessments

Parenting Stress

The Parenting Stress Index Short Form (PSI-SF) is a 36-item self-report questionnaire that was used to measure baseline parenting stress at pre-intervention (Abidin, 1995). The PSI-SF assesses the stress that parents of children younger than 12 years of age experience in their caregiving role. It consists of three subscales: Parent Distress, which measures the extent to which a parent feels competent, conflicted, and/or supported in their role as a parent; Parent-Child Dysfunction, which measures the extent to which a parent feels satisfied with their child and their interactions with them; and Difficult Child, which measures the extent to which a parent perceives their child as easy or difficult to take care of. Each item is rated on a scale from 1 (Strongly Disagree) to 5 (Strongly Agree) with higher scores indicating greater parenting stress. The PSI-SF shows strong internal consistency ($\propto$=0.91) and has been used in studies of parents of toddlers with disabilities (e.g., Button et al., 2001; Trute & Hiebert-Murphy, 2005), including ASD (e.g., Davis & Carter, 2008; Zaidman-Zait et al., 2011). The parenting stress variables used in the present analyses were the average of the total scores as well as the average of each of the subscale scores. Scores for missing items were imputed according to Abidin (1995).

Parents' use of intervention strategies

To measure parents' use of ImPACT strategies at pre- and post-intervention, the parent–child free play (PCFP) assessment was administered. The PCFP is a 15-minute unstructured activity during which the parent and child sit on the floor with a set of developmentally appropriate toys. The parent is then instructed to "Play as you would at home if you had no interruptions and had time to play with your child" (Yoder et al., 2015). Importantly, the present study examined the generalized use of ImPACT strategies since these strategies were assessed in

a different setting than the coaching sessions in which they were taught with different toys and materials than used during active treatment.

A modified version of the *NDBI-Fi* was used in the present study to assess parents' use of intervention strategies (Frost et al., 2020). The *NDBI-Fi* is an eight-item observational scheme for measuring adherence to the common elements of NDBIs. It is rated on a 5-point, Likert-type scale, with higher ratings indicating greater fidelity. Five ratings were used in the present study: (a) face-to-face positioning, (b) following the child's lead, (c) positive affect and animation, (d) response to child communication attempts, and (e) use of communicative temptations, which refers to creating opportunities for a child to use verbal or nonverbal communication to request or share. As an example, within the face-to-face positioning rating, a parent would score a 5 if they maintained a face-to-face position throughout the session by adjusting quickly when the child moves to remain at eye level, they would score a 3 if they maintained a face to face position about half of the time, and they would score a 1 if they were almost always seated or standing behind or above the child rather than at a face to face position. The other three ratings from the original *NDBI-Fi* measure (e.g., direct teaching episodes) were not well-elicited by the PCFP and thus, were not included in the larger study. Overall fidelity ratings were averaged across the five ratings. An average score between 4 and 5 indicated parents' use of these strategies more than half of the time during the PCFP.

Independent coders were trained to reliability for rating videotapes using the NDBI-Fi, which involved obtaining an intraclass correlation coefficient (ICC) greater than 0.69 on at least five videos. Reliability estimates were examined for at least 20% of all sessions to decrease observer drift. After each reliability check, discrepancies were discussed between the coders. Coders were unaware of which sessions would be checked for reliability and were masked to the

family's treatment assignment and timepoint. *NDBI-Fi* reliability estimates for each of the items at both time points were greater than the accepted threshold of ICC > 0.69, except for communicative temptations at pre-intervention, which was 0.60.

Child cognitive scores

The Mullen Scales of Early Learning (MSEL; Mullen, 1995) was used to evaluate children's cognitive development at pre-intervention. It is a standardized cognitive assessment with four domains that assess skills in the areas of visual reception, fine motor, expressive language, and receptive language. The Early Learning Composite, which is a standard score across the four domains with mean of 100 (*SD*: 15), was used to obtain an estimate of children's cognitive development.

Child social communication

Child social communication at pre-intervention was measured using the Communication and Symbolic Behavior Scales (CSBS). The CSBS is a standardized, play-based measure that assesses communication, symbolic (e.g., gestures), and play development (Wetherby & Prizant, 2003). Trained coders identified instances of social communication behaviors using a timed-event sampling method from the 15-minute behavior sample portion of the CSBS, which includes probes intended to elicit children's communication (e.g., requesting snack, play routines with balloons and bubbles, and book sharing), to examine children's language comprehension (e.g., object or body part names), and to evaluate children's symbolic and constructive play skills. The four non-mutually exclusive categories of social communication behaviors were: (a) coordinated cues (the combined use of at least three of the following behaviors: smiles, word/vocalization, gesture, and eye gaze within three seconds); (b) positive affect sharing (i.e., smile with a coordinated gaze); (c) showing or pointing; and (d) sharing interest (use of gesture

or vocalization for this expressed purpose). For the present analyses, an overall social communication score was obtained by averaging across the four categories of behaviors.

Analytic Approach

Analyses were performed using R statistical software (R Core Team, 2020). To assess whether pre-intervention parenting-related stress impacted parents' use of intervention strategies, a hierarchal linear regression analysis was used to first assess the relationship between the main effect of parents' use of intervention strategies at pre and post intervention timepoints. Next, the interaction term between parents' use of intervention strategies at pre-intervention and pre-intervention parenting-related stress was added to evaluate its effect on parents' use of intervention strategies at post-intervention (see Figure 1). Analyses were performed using an intent to treat analysis and the mice() function in R (van Buuren & Groothuis-Oudshoorn, 2011) was used to impute the missing values. First, regression analyses were run using the PSI-SF averaged total scores. Then, to determine whether any one subscale contributed more to parents' use of intervention strategies, each of the three subscales was entered separately in the model as exploratory analyses.

Results

Preliminary Analyses

Age at study entry, cognitive standard scores, and child sex did not predict parents' post-intervention strategy use (*p*s = .19, .71, .86, respectively); however, child social communication at pre-intervention did significantly predict parents' strategy use in the positive direction at post-intervention ($F(1, 47) = 6.66$, $p = .01$), indicating that parents of children with higher social communication scores demonstrated higher use of the intervention strategies. Therefore, child

social communication was included as a predictor in the primary analyses. Descriptive statistics for all study variables included in the final model are presented in Table 2.

Main Analyses

Regression analyses indicated a main effect of parents' pre-intervention strategy use (M = 2.67, SD = .65) on their post-intervention strategy use (M = 3.44, SD = .78), $F(1, 46) = 15.46$, $p < .001$, indicating that parents' strategy use at pre-intervention significantly predicted their strategy use at post-intervention. A figure depicting the correlation between pre- and post-intervention strategy use is shown in Figure 2. However, analyses revealed that the interaction term between parents' use of intervention strategies at post-intervention and parenting-related stress was not significant ($p = .96$). Thus, parenting-related stress did not act as a moderator between parents' use of intervention strategies at pre- and post-intervention.

Post hoc analyses

Post hoc analyses that examined the individual PSI-SF subscales separately as potential moderators were conducted to further explore the results. These analyses indicated no significant interactions with any of the subscales, reflecting the same trend as with the total PSI-SF score: Parent-Child Dysfunction, $F(1, 44) = .33$, $p = .57$; Parent Distress, $F(1, 44) = 1.02$, $p = .32$; Difficult Child, $F(1, 44) = .15$, $p = .70$.

Discussion

The purpose of this study was to examine the impact of parenting-related stress on parents' use of intervention strategies in a pre-emptive, parent-mediated treatment study for toddlers at familial risk for ASD. This study is one of a few that has analyzed the relationship between parent treatment adherence and parenting-related stress within a PMI. Previous studies

have yielded mixed findings and this study was meant to provide more clarity regarding this relationship.

Results revealed that, unsurprisingly, parents' use of intervention strategies at pre-intervention predicted parents' use of intervention strategies at post-intervention. However, there was no significant relationship between parenting-related stress and parents' use of intervention strategies at post-intervention, when controlling for use of intervention strategies at pre-intervention. Additionally, looking at each of the subscales separately yielded similar findings, with no significant variance in parents' use of intervention strategies accounted for by parenting-related stress. These findings, thus, do not support the hypothesis that higher levels of parenting-related stress may negatively impact parents' deliverance of learned intervention strategies. Some possible explanations for these unexpected findings are discussed in detail below.

There may be several reasons for a lack of predicted results. First**,** prior to participation in Project ImPACT, some parents in this study already demonstrated use of intervention strategies before they were taught. Specifically, 38% of parents (19/49) used these strategies at least half of the time during the 15-minute PCFP at pre-intervention (i.e., an overall fidelity rating between 3 and 4 out of a 5-point rating scale) and another 48.9% of parents (24/49) also occasionally used these intervention strategies (i.e., an overall fidelity rating between 2 and 3 out of a 5-point rating scale). This finding indicates that these parents were already using these strategies, albeit possibly inconsistently, with their children prior to starting the PMI. Interestingly, when examining the specific intervention strategies that parents used prior to being formally taught, 85.7% of parents (42/49) appropriately responded to their child's verbal and non-verbal communication attempts, 75.5% of parents (37/49) followed their child's lead within play or other activities, and 51% of parents (25/49) showed positive affect and animation at least

half of the time during the 15-minute PCFP. Because these parents were already engaging in these strategies at pre-intervention, there may have been less room for growth, and thus, less possible impact of parenting-related stress.

Second**,** the nature of the sample could give us more insight into the unexpected results. Since this is a familial high-risk sample, these toddlers are at elevated risk of receiving an ASD diagnosis but may not necessarily be showing any ASD symptoms yet. In this sample, 14 of the 49 children received a diagnosis of ASD at the last study visit. Thus, parents may not be experiencing high levels of stress related to this child. Additionally, since these parents have an older child with ASD and are privy to the difficulties and struggles that come with rearing a child with ASD, they may not rate their parenting-related stress levels for the child in this study as highly as other parents might. Indeed, in this sample, the average total PSI-SF score was 72.3, within the typical stress range. Furthermore, a majority of parents (35 out of 49; 71.4%) scored within the typical stress range, five parents (10.2%) scored within the High Stress range, and eight parents (16.3%) scored within the Clinically Significant range (Abidin, 1995). In contrast, a study by Green and Carter (2014) found that, in their sample, when mothers considered their toddlers with diagnosed ASD, they reported an average parenting-related stress score (based on the PSI-SF total scores) of 83.85, within the High Stress range. Thus, it may be that, even though some of these parents are reporting elevated parenting-related stress scores, the majority of scores may not be sufficiently high to impact treatment adherence.

Finally**,** looking into the two other studies that have examined the relationship between parent treatment adherence and parenting-related stress may provide more understanding into the unexpected finding. As previously mentioned, Rollins and colleagues (2019) found no significant relationship between parent treatment adherence and parenting-related stress in the

PMI group but did find one in the TAU group. Interestingly, the ratings of the *NDBI-Fi* measure used in the current study seem to be conceptually similar to the responsivity measure used in the Rollins study (2019). For example, parents were rated responsive if they followed and joined their child's actions using non-demanding verbal or nonverbal language (Rollins et al., 2019). Likewise, in the *NDBI-Fi* ratings, parents received a higher fidelity score if they followed their child's lead and responded appropriately to their communication attempts. In contrast, Carr and colleagues (2016) found a significant relationship between parent treatment adherence and parenting-related stress, with higher parenting-related stress related to *better* treatment adherence. However, Carr et al. (2016) used a self-report measure of treatment adherence, which may have led to socially desirable responses. Although the finding that parenting-related stress does not play a role in parents' use of intervention strategies within a PMI was unexpected, it may be due, in part, to common method variance (i.e., the type of measurement used to capture parents' treatment adherence).

This study had several limitations. First, much of the variance in parents' use of intervention strategies at post-intervention was accounted for by their use at pre-intervention, which may have impacted the potential for parenting-related stress to have an effect. Furthermore, there may be specific characteristics of parents who participate in intensive RCT intervention studies, which makes them more prone to learn and use the strategies, regardless of their parenting-related stress level, as compared to parents who may not have the resources or opportunity to join such a study. These parents were not only motivated to enroll their possibly asymptomatic toddler in an intervention study, but also had the time and resources to do so. Finally, this was a homogenous sample of highly educated, predominantly White mothers, further demonstrating that this may be a unique sample with more resources or social buffers.

Thus, it is possible that their own parenting-related stress had less of an impact on their ability to adhere to the PMI than might be the case for families who do not have similar forms of support. Future research should expand upon the work of Carr et al. (2016) and examine parenting stress and intervention fidelity within a community sample that is more representative.

Other future directions include examining other contributing forms of stress. Parenting-related stress is a specific construct regarding the stress around the parenting role; however, it does not capture stress related to other aspects of daily life, such as workplace, marital relations, or financial stress. Stressors from other areas of parents' lives could impact their ability to adhere to intervention strategies as they attempt to manage not only their role as a caregiver, but also as their child's treatment provider. Furthermore, parenting-related stress is likely to be one of many factors that impact parent treatment adherence. Parent training studies in general child development literature have revealed that SES, caregiver social support, parent buy-in, and marital/financial stress may impact treatment adherence (Baker et al., 2011; Kazdin, 2000; Lavigne et al., 2010; Nock & Kazdin, 2001).

Additionally, future research could investigate alternative approaches to measuring parenting-related stress and treatment adherence ratings to further strengthen the validity and reliability of these variables. Multi-modal methods are becoming increasingly common as a way to bolster construct measurement. For example, to increase objectivity of the results, research could complement self-report methods with physiological measures of stress such as heart rate variability (HRV; Factor et al., 2017). In addition, one of the benefits of PMI is that parents can embed these strategies into daily routines and quick exchanges throughout the day. However, the field has yet to determine an effective and accurate way of assessing parents' daily intervention use that does not raise concerns of privacy and feasibility (e.g., routine visits from staff into

family's home) as well as possible bias (e.g., parents providing daily self-report). Thus, although we can assess parents' use of strategies within the research setting or through parent report, we may have an imprecise understanding of parents' daily intervention intensity and fidelity and the factors that impact them. Furthermore, as shown above, the measurement approach researchers choose to assess parent treatment adherence (e.g., self-report vs. observational data) may impact findings.

To our knowledge, this study was the first to look at how parenting-related stress may impact parents' use of observed intervention strategies within a pre-emptive PMI for toddlers at familial risk for ASD. Although it may be the case that parenting-related stress has no effect on parents' treatment adherence, due to some limitations of this study and the current dearth of literature, future work is needed to better understand this relationship, given the strong association between parent treatment adherence and child treatment outcomes. As the field continues to move towards PMI, it is important to understand which factors impact parent treatment adherence in order to best assist parents as treatment providers. Parents of children with ASD continue to take on multiple responsibilities such as caretaker, service provider, and advocate; therefore, future work should also focus on how to provide essential support to parents to help alleviate likely burden.

Table 1. Pre-intervention participant demographics

Variable	Intervention Group *n* = 49
Caregiver	
Primary Caregiver: Mother (vs. father or other), *n* (%)	42, 87.5
Education: College (vs. no college), *n* (%)	46, 93.8
Child	
Age, mean (SD), range (y)	14.11 (2.31), 11.43-18.43
Sex: Male, *n* (%)	27, 55.1
Race: White (vs. non-white), *n* (%)	38, 79.2
Cognitive Standard Score, mean (SD), range (y)	89.27 (16.79), 58-126

Table 2. Descriptive statistics for study variables included in final model

Construct	*M* (*SD*)	Range
Child social communication (total number of instances of child's social communication behaviors)	26.39 (21.19)	0-81
Parenting-related stress (PSI-SF total scores)	72.27 (18.84)	38-114
Parents' average use of intervention strategies (*NDBI-Fi* scores)		
Pre-intervention	2.67 (0.65)	1.4-4.2
Post-intervention	3.44 (0.78)	1.4-4.8

Note: PSI-SF = Parenting Stress Index-Short Form with possible total scores of 36-180 (Abidin, 1995); *NDBI-Fi* scores rated on a 5-point scale with higher scores indicating greater use of strategies (Frost et al., 2020)

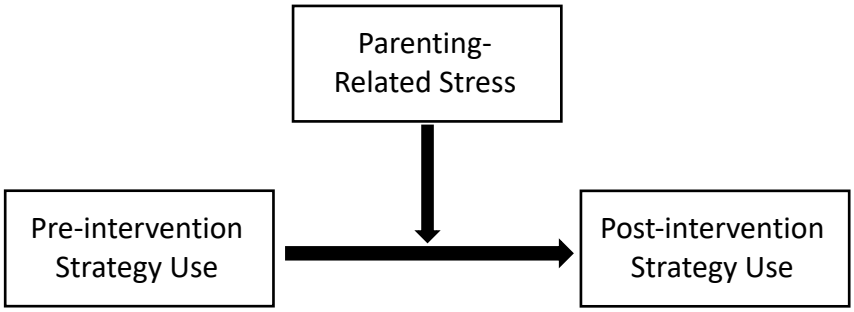

Figure 1. Hypothesized model of moderation such that parenting-related stress will impact parents' change in intervention strategy use from pre- to post-intervention.

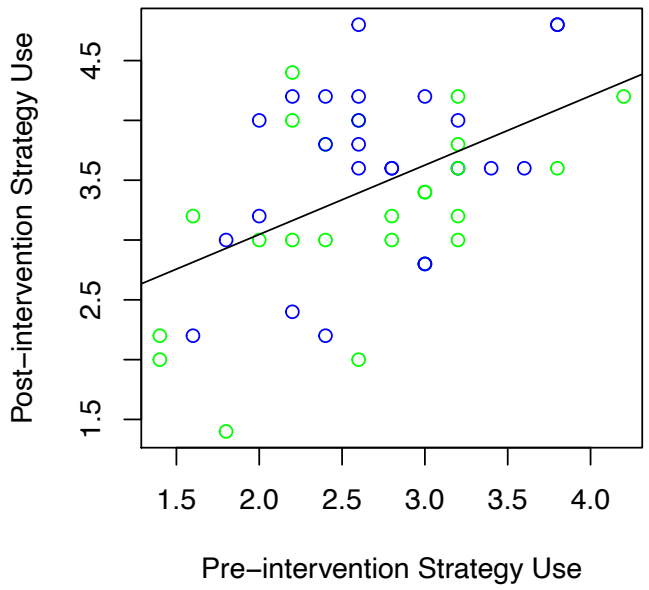

Figure 2. Correlation matrix between parents' pre-intervention and post-intervention use of intervention strategies. The scores are highly correlated ($r(47) = .48$, $p < .001$).

References

Abidin, R. R. (1995). Parenting stress index (3rd ed.). Lutz, FL: Psychological Assessment Resources.

American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.).

Arunyanart, W., Fenick, A., Ukritchon, S., Imjaijitt, W., Northrup, V., & Weitzman, C. (2012). Developmental and autism screening: A survey across six states. Infants & Young Children, 25(3), 175-187.

Baker, C. N., Arnold, D. H., & Meagher, S. (2011). Enrollment and attendance in a parent training prevention program for conduct problems. Prevention Science, 12(2), 126-138.

Blacher, J., & McIntyre, L. L. (2006). Syndrome specificity and behavioural disorders in young adults with intellectual disability: Cultural differences in family impact. Journal of Intellectual Disability Research, 50(3), 184–198.

Bradshaw, J., Koegel, L. K., & Koegel, R. L. (2017). Improving functional language and social motivation with a parent-mediated intervention for toddlers with autism spectrum disorder. Journal of autism and developmental disorders, 47(8), 2443-2458.

Brian, J. A., Smith, I. M., Zwaigenbaum, L., & Bryson, S. E. (2017). Cross-site randomized control trial of the Social ABCs caregiver-mediated intervention for toddlers with autism spectrum disorder. *Autism Research*, *10*(10), 1700-1711.

Brookman-Frazee, L., Vismara, L., Drahota, A., Stahmer, A., & Openden, D. (2009). Parent training interventions for children with autism spectrum disorders. In Applied behavior analysis for children with autism spectrum disorders (pp. 237-257). Springer, New York, NY.

Button, S., Pianta, R. C., & Marvin, R. S. (2001). Partner support and maternal stress in families raising young children with cerebral palsy. Journal of Developmental and physical disabilities, 13(1), 61-81.

Carbone, P. S., Murphy, N. A., Norlin, C., Azor, V., Sheng, X., & Young, P. C. (2013). Parent and pediatrician perspectives regarding the primary care of children with autism spectrum disorders. Journal of Autism and Developmental Disorders, 43(4), 964-972.

Carr, T., Shih, W., Lawton, K., Lord, C., King, B., & Kasari, C. (2016). The relationship between treatment attendance, adherence, and outcome in a caregiver-mediated intervention for low-resourced families of young children with autism spectrum disorder. Autism, 20(6), 643-652.

Carroll, C., Patterson, M., Wood, S., Booth, A., Rick, J., & Balain, S. (2007). A conceptual framework for implementation fidelity. Implementation Science, 2, Article 40. doi:10.1186/1748-5908-2-40

Charman, T., Young, G. S., Brian, J., Carter, A., Carver, L. J., Chawarska, K., ... Zwaigenbaum, L. (2016). Non-ASD out- comes at 36 months in siblings at familial risk for autism spectrum disorder (ASD): A baby siblings research consortium (BSRC) study. Autism Research, 10(1), 169–178.

Craig, F., Operto, F. F., De Giacomo, A., Margari, L., Frolli, A., Conson, M., ... & Margari, F. (2016). Parenting stress among parents of children with neurodevelopmental disorders. Psychiatry research, 242, 121-129.

Crais, E. R., McComish, C. S., Humphreys, B. P., Watson, L. R., Baranek, G. T., Reznick, J. S.,

... & Earls, M. (2014). Pediatric healthcare professionals' views on autism spectrum disorder screening at 12–18 months. Journal of autism and developmental disorders, 44(9), 2311-2328.

Davis, N. O., & Carter, A. S. (2008). Parenting stress in mothers and fathers of toddlers with autism spectrum disorders: Asso- ciations with child characteristics. Journal of Autism and Developmental Disorders, 38(7), 1278–1291.

Dawson, G., Rogers, S., Munson, J., Smith, M., Winter, J., Greenson, J., ... & Varley, J. (2010). Randomized, controlled trial of an intervention for toddlers with autism: the Early Start Denver Model. Pediatrics, 125(1), e17-e23.

Deater-Deckard, K. (2004). Parenting stress. New Haven: Yale University Press.

Deater-Deckard, K. (1998). Parenting stress and child adjustment: Some old hypotheses and new questions. Clinical psychology: Science and practice, 5(3), 314.

DesChamps, T. D., Ibañez, L. V., Edmunds, S. R., Dick, C. C., & Stone, W. L. (2020). Parenting stress in caregivers of young children with ASD concerns prior to a formal diagnosis. Autism Research, 13(1), 82-92.

Factor, R. S., Swain, D. M., & Scarpa, A. (2018). Child autism spectrum disorder traits and parenting stress: The utility of using a physiological measure of parental stress. Journal of Autism and Developmental Disorders, 48(4), 1081-1091.

Fava, L., Strauss, K., Valeri, G., D'Elia, L., Arima, S., & Vicari, S. (2011). The effectiveness of a cross-setting complementary staff-and parent-mediated early intensive behavioral intervention for young children with ASD. Research in Autism Spectrum Disorders, 5(4), 1479-1492.

Firth, I., & Dryer, R. (2013). The predictors of distress in parents of children with autism

spectrum disorder. Journal of Intellectual and Developmental Disability, 38(2), 163-171.

Frost, K. M., Brian, J., Gengoux, G. W., Hardan, A., Rieth, S. R., Stahmer, A., & Ingersoll, B. (2020). Identifying and measuring the common elements of naturalistic developmental behavioral interventions for autism spectrum disorder: Development of the NDBI-Fi. Autism, 24(8), 2285-2297.

Gabriels, R. L., Cuccaro, M. L., Hill, D. E., Ivers, B. J., & Goldson, E. (2005). Repetitive behaviors in autism: Relation- ships with associated clinical features. Research in Developmental Disabilities, 26(2), 169–181.

Gearing, R. E., El-Bassel, N., Ghesquiere, A., Baldwin, S., Gillies, J., & Ngeow, E. (2011). Major ingredients of fidelity: a review and scientific guide to improving quality of intervention research implementation. Clinical psychology review, 31(1), 79-88.

Gitlin, L. N., & Parisi, J. M. (2016). Are treatment effects real? The role of fidelity. Behavioral Intervention Research: Designing, Evaluating and Implementing. New York: Springer Publishing.

Gordon-Lipkin, E., Foster, J., & Peacock, G. (2016). Whittling down the wait time: exploring models to minimize the delay from initial concern to diagnosis and treatment of autism spectrum disorder. Pediatric Clinics, 63(5), 851-859.

Green, S. A., & Carter, A. S. (2014). Predictors and course of daily living skills development in toddlers with autism spectrum disorders. Journal of autism and developmental disorders, 44(2), 256-263.

Green, J., Pickles, A., Pasco, G., Bedford, R., Wan, M. W., Elsabbagh, M., ... & McNally, J.

(2017). Randomised trial of a parent-mediated intervention for infants at high risk for autism: Longitudinal outcomes to age 3 years. Journal of Child Psychology and Psychiatry, 58(12), 1330-1340.

Gulsrud, A. C., Hellemann, G., Shire, S., & Kasari, C. (2016). Isolating active ingredients in a parent-mediated social communication intervention for toddlers with autism spectrum disorder. Journal of Child Psychology and Psychiatry, 57(5), 606-613.

Hall, H. R., & Graff, J. C. (2011). The relationships among adaptive behaviors of children with autism, family support, parenting stress, and coping. Issues in comprehensive pediatric nursing, 34(1), 4-25.

Hallmayer, J., Cleveland, S., Torres, A., Phillips, J., Cohen, B., Torigoe, T., ... & Risch, N. (2011). Genetic heritability and shared environmental factors among twin pairs with autism. Archives of general psychiatry, 68(11), 1095-1102.

Hartley, S., Barker, E., Seltzer, M., Floyd, F. J., Greenberg, J. S., Orsmond, G., & Bolt, D. (2010). The relative risk and timing of divorce in families of children with an autism spectrum disorder. Journal of Family Psychology, 24(4), 449–457.

Hastings, R. P., Kovshoff, H., Ward, N. J., Degli Espinosa, F., Brown, T., & Remington, B. (2005). Systems analysis of stress and positive perceptions in mothers and fathers of pre-school children with autism. Journal of autism and developmental disorders, 35(5), 635-644.

Hayes, S. A., & Watson, S. L. (2013). The impact of parenting stress: A meta-analysis of studies comparing the experience of parenting stress in parents of children with and without autism spectrum disorder. Journal of autism and developmental disorders, 43(3), 629-642.

Hock, R., Kinsman, A., & Ortaglia, A. (2015). Examining treatment adherence among parents of children with autism spectrum disorder. Disability and health journal, 8(3), 407-413.

Ingersoll, B. (2010). Brief report: Pilot randomized controlled trial of reciprocal imitation training for teaching elicited and spontaneous imitation to children with autism. Journal of autism and developmental disorders, 40(9), 1154-1160.

Ingersoll, B., & Dvortcsak, A. (2010). Teaching social communication to children with autism: A practitioner's guide to parent training and a manual for parents. Guilford Press.

Ingersoll, B., & Wainer, A. (2013). Initial efficacy of Project ImPACT: A parent-mediated social communication intervention for young children with ASD. Journal of autism and developmental disorders, 43(12), 2943-2952.

Ingersoll, B., Wainer, A. L., Berger, N. I., Pickard, K. E., & Bonter, N. (2016). Comparison of a self-directed and therapist-assisted telehealth parent-mediated intervention for children with ASD: A pilot RCT. Journal of Autism and Developmental Disorders, 46(7), 2275-2284.

Kasari, C., Gulsrud, A., Paparella, T., Hellemann, G., & Berry, K. (2015). Randomized comparative efficacy study of parent-mediated interventions for toddlers with autism. Journal of consulting and clinical psychology, 83(3), 554.

Kasari, C., Gulsrud, A. C., Wong, C., Kwon, S., & Locke, J. (2010). Randomized controlled caregiver mediated joint engagement intervention for toddlers with autism. Journal of autism and developmental disorders, 40(9), 1045-1056.

Kasari, C., & Sigman, M. (1997). Linking parental perceptions to interactions in young children with autism. Journal of autism and developmental disorders, 27(1), 39-57.

Kazdin, A. E. (2000). Perceived barriers to treatment participation and treatment acceptability

among antisocial children and their families. Journal of Child and Family Studies, 9(2), 157-174.

Koegel, R. L., & Koegel, L. K. (2006). Pivotal response treatments for autism: Communication, social, & academic development. Paul H Brookes Publishing.

Landa, R. J., Holman, K. C., O'Neill, A. H., & Stuart, E. A. (2011). Intervention targeting development of socially synchronous engagement in toddlers with autism spectrum disorder: A randomized controlled trial. Journal of Child Psychology and Psychiatry, 52(1), 13-21.

Lavigne, J. V., LeBailly, S. A., Gouze, K. R., Binns, H. J., Keller, J., & Pate, L. (2010). Predictors and correlates of completing behavioral parent training for the treatment of oppositional defiant disorder in pediatric primary care. Behavior therapy, 41(2), 198-211.

Lecavalier, L., Leone, S., & Wiltz, J. (2006). The impact of behaviour problems on caregiver stress in young people with autism spectrum disorders. Journal of intellectual disability research, 50(3), 172-183.

Maenner, M. J., Shaw, K. A., & Baio, J. (2020). Prevalence of autism spectrum disorder among children aged 8 years—autism and developmental disabilities monitoring network, 11 sites, United States, 2016. *MMWR Surveillance Summaries*, *69*(4), 1.

Mannion, A., & Leader, G. (2013). Comorbidity in autism spectrum disorder: A literature review. Research in Autism Spectrum Disorders, 7(12), 1595-1616.

Martinez, M., Thomas, K. C., Williams, C. S., Christian, R., Crais, E., Pretzel, R., & Hooper, S. R. (2018). Family experiences with the diagnosis of autism spectrum disorder: System barriers and facilitators of efficient diagnosis. Journal of autism and developmental disorders, 48(7), 2368-2378.

Matson, J. L., Adams, H. L., Williams, L. W., & Rieske, R. D. (2013). Why are there so many unsubstantiated treatments in autism?. Research in Autism Spectrum Disorders, 7(3), 466-474.

McStay, R. L., Dissanayake, C., Scheeren, A., Koot, H. M., & Begeer, S. (2014). Parenting stress and autism: The role of age, autism severity, quality of life and problem behaviour of children and adolescents with autism. Autism, 18(5), 502-510.

McStay, R. L., Trembath, D., & Dissanayake, C. (2014). Stress and family quality of life in parents of children with autism spec- trum disorder: Parent gender and the double ABCX model. Journal of Autism and Developmental Disorders, 44(12), 3101–3118.

Minjarez, M. B., Mercier, E. M., Williams, S. E., & Hardan, A. Y. (2012). Assessing the impact of pivotal response group therapy on parenting stress and empowerment levels. Journal of Positive Behavior Interventions, 15, 71-78.

Mire, S. S., Gealy, W., Kubiszyn, T., Burridge, A. B., & Goin-Kochel, R. P. (2017). Parent perceptions about autism spectrum disorder influence treatment choices. Focus on Autism and Other Developmental Disabilities, 32(4), 305-318.

Moh, T. A., & Magiati, I. (2012). Factors associated with parental stress and satisfaction during the process of diagnosis of children with autism spectrum disorders. Research in Autism Spectrum Disorders, 293–303.

Mullen, E. M. (1995). Mullen scales of early learning. AGS Circle Pines.

Mulligan, J., Macculloch, R., Good, B., & Nicholas, D. B. (2012). Transparency, hope, and empowerment: A model for partnering with parents of a child with autism spectrum disorder at diagnosis and beyond. Social Work in Mental Health, 10(4), 311-330.

National Research Council. (2001). Educating children with autism. National Academies Press.

Neece, C. L., Green, S. A., & Baker, B. L. (2012). Parenting stress and child behavior problems: A transactional relationship across time. American journal on intellectual and developmental disabilities, 117(1), 48-66.

Nevill, R. E., Lecavalier, L., & Stratis, E. A. (2018). Meta-analysis of parent-mediated interventions for young children with autism spectrum disorder. Autism, 22(2), 84-98.

Nock, M. K., & Kazdin, A. E. (2001). Parent expectancies for child therapy: Assessment and relation to participation in treatment. Journal of Child and Family Studies, 10(2), 155-180.

Ozonoff, S., Young, G. S., Landa, R. J., Brian, J., Bryson, S., Charman, T., ... & Iosif, A. M. (2015). Diagnostic stability in young children at risk for autism spectrum disorder: a baby siblings research consortium study. Journal of Child Psychology and Psychiatry, 56(9), 988-998.

Ozonoff, S., Young, G. S., Carter, A., Messinger, D., Yirmiya, N., Zwaigenbaum, L., ... & Stone, W. L. (2011). Recurrence risk for autism spectrum disorders: a Baby Siblings Research Consortium study. Pediatrics, 128(3), e488-e495.

Peters-Scheffer, N., Didden, R., & Korzilius, H. (2012). Maternal stress predicted by characteristics of children with autism spectrum disorder and intellectual disability. Research in Autism Spectrum Disorders, 6(2), 696-706.

Phetrasuwan, S., & Shandor Miles, M. (2009). Parenting stress in mothers of children with autism spectrum disorders. Journal for Specialists in Pediatric Nursing, 14(3), 157–165.

Pierce, K., Gazestani, V. H., Bacon, E., Barnes, C. C., Cha, D., Nalabolu, S., ... & Courchesne,

E. (2019). Evaluation of the diagnostic stability of the early autism spectrum disorder phenotype in the general population starting at 12 months. JAMA pediatrics, 173(6), 578-587.

Plant, K. M., & Sanders, M. R. (2007). Predictors of care-giver stress in families of preschool-aged children with developmental disabilities. Journal of intellectual disability research, 51(2), 109-124.

R Core Team (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Rezendes, D. L., & Scarpa, A. (2011). Associations between parental anxiety/depression and child behavior problems related to autism spectrum disorders: The roles of parenting stress and parenting self-efficacy. Autism Research and Treatment, 2011.

Rickards, A. L., Walstab, J. E., Wright-Rossi, R. A., Simpson, J., & Reddihough, D. S. (2007). A randomized, controlled trial of a home-based intervention program for children with autism and developmental delay. Journal of Developmental and Behavioral Pediatrics, 28(4), 308–316.

Roberts, M. Y., & Kaiser, A. P. (2011). The effectiveness of parent-implemented language interventions: A meta-analysis.

Rodriguez, G., Hartley, S. L., & Bolt, D. (2019). Transactional relations between parenting stress and child autism symptoms and behavior problems. Journal of Autism and Developmental Disorders, 49 (5), 1887–1898.

Rollins, P. R., John, S., Jones, A., & De Froy, A. (2019). Pathways early ASD intervention as a moderator of parenting stress on parenting behaviors: A randomized control trial. Journal of autism and developmental disorders, 49(10), 4280-4293.

Salehi, B., Cordero, M. I., & Sandi, C. (2010). Learning under stress: the inverted-U-shape function revisited. *Learning & memory*, *17*(10), 522-530.

Salomone, E., Leadbitter, K., Aldred, C., Barrett, B., Byford, S., Charman, T., ... Vamvakas, G. (2018). The association between child and family characteristics and the mental health and wellbeing of caregivers of children with autism in mid-child- hood. Journal of Autism and Developmental Disorders, 48(4), 1189–1198.

Sansosti, F. J., Lavik, K. B., & Sansosti, J. M. (2012). Family experiences through the autism diagnostic process. Focus on Autism and Other Developmental Disabilities, 27(2), 81-92.

Schreibman, L., Dawson, G., Stahmer, A. C., Landa, R., Rogers, S. J., McGee, G. G., ... & Halladay, A. (2015). Naturalistic developmental behavioral interventions: Empirically validated treatments for autism spectrum disorder. Journal of autism and developmental disorders, 45(8), 2411-2428.

Shalev, R. A., Lavine, C., & Di Martino, A. (2020). A systematic review of the role of parent characteristics in parent-mediated interventions for children with autism spectrum disorder. Journal of Developmental and Physical Disabilities, 32(1), 1-21.

Singer, G. H. (2006). Meta-analysis of comparative studies of depression in mothers of children with and without develop- mental disabilities. American Journal on Mental Retardation, 111(3), 155–169.

Stadnick, N. A., Stahmer, A., & Brookman-Frazee, L. (2015). Preliminary effectiveness of Project ImPACT: A parent-mediated intervention for children with autism spectrum disorder delivered in a community program. Journal of autism and developmental disorders, 45(7), 2092-2104.

Strauss, K., Vicari, S., Valeri, G., D'Elia, L., Arima, S., & Fava, L. (2012). Parent inclusion in

early intensive behavioral intervention: The influence of parental stress, parent treatment fidelity and parent-mediated generalization of behavior targets on child outcomes. Research in Developmental Disabilities, 33(2), 688–703.

Tick, B., Bolton, P., Happé, F., Rutter, M., & Rijsdijk, F. (2016). Heritability of autism spectrum disorders: a meta-analysis of twin studies. Journal of Child Psychology and Psychiatry, 57(5), 585-595.

Tomlin, A., Koch, S. M., Raches, C., Minshawi, N. F., & Swiezy, N. B. (2013). Autism screening practices among early intervention providers in Indiana. Infants & Young Children, 26(1), 74-88.

Trute, B., & Hiebert-Murphy, D. (2005). Predicting family adjustment and parenting stress in childhood disability services using brief assessment tools. Journal of Intellectual and Developmental Disability, 30(4), 217-225.

Van Buuren, S., & Groothuis-Oudshoorn, K. (2011). mice: Multivariate imputation by chained equations in R. Journal of statistical software, 45(1), 1-67.

Vismara, L. A., Colombi, C., & Rogers, S. J. (2009). Can one hour per week of therapy lead to lasting changes in young children with autism?. Autism, 13(1), 93-115.

Watson, L. R., Crais, E. R., Baranek, G. T., Turner-Brown, L., Sideris, J., Wakeford, L., ... & Nowell, S. W. (2017). Parent-mediated intervention for one-year-olds screened as at-risk for autism spectrum disorder: a randomized controlled trial. Journal of autism and developmental disorders, 47(11), 3520-3540.

Webb, S. J., & Jones, E. J. (2009). Early Identification of Autism: Early Characteristics, Onset of Symptoms, and Diagnostic Stability. Infants and young children, 22(2), 100–118.

Wetherby, A. M., Guthrie, W., Woods, J., Schatschneider, C., Holland, R. D., Morgan, L., &

Lord, C. (2014). Parent-implemented social intervention for toddlers with autism: an RCT. Pediatrics, 134(6), 1084-1093.

Wetherby, A. M., & Prizant, B. M. (2003). Communication and Symbolic Behavior Scales developmental profile (1st ed.). Brookes. https://doi.org/10.1037/t11529-000

Wetherby, A. M., & Woods, J. U. L. I. A. N. N. (2008). Developmental approaches to treatment. Autism spectrum disorders in infants and toddlers: Diagnosis, assessment, and treatment, 170-206.

World Health Organization. (2016). Questions and answers about autism spectrum disorders (ASD). Retrieved from: http://www.who.int/features/qa/85/en/ (accessed 1 June 2016).

Yoder, P. J., Stone, W. L., & Edmunds, S. R. (2021). Parent utilization of ImPACT intervention strategies is a mediator of proximal then distal social communication outcomes in younger siblings of children with ASD. Autism, 25(1), 44-57.

Yoder, P., Watson, L. R., & Lambert, W. (2015). Value-added predictors of expressive and receptive language growth in initially nonverbal preschoolers with autism spectrum disorders. Journal of autism and developmental disorders, 45(5), 1254-1270.

Zaidman-Zait, A., Mirenda, P., Zumbo, B. D., Georgiades, S., Szatmari, P., Bryson, S., ... & Pathways in ASD Study Team. (2011). Factor analysis of the Parenting Stress Index-Short Form with parents of young children with autism spectrum disorders. Autism Research, 4(5), 336-346.

Zuckerman, K. E., Lindly, O. J., & Sinche, B. K. (2015). Parental concerns, provider response, and timeliness of autism spectrum disorder diagnosis. The Journal of pediatrics, 166(6), 1431-1439.

Zwaigenbaum, L., & Maguire, J. (2019). Autism screening: Where do we go from here?.

Pediatrics, 144(4).

Zwaigenbaum, L., Bauman, M. L., Choueiri, R., Kasari, C., Carter, A., Granpeesheh, D., ... & Natowicz, M. R. (2015). Early intervention for children with autism spectrum disorder under 3 years of age: recommendations for practice and research. Pediatrics, 136(Supplement 1), S60-S81.