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Compliance in Toddlers with Autism Spectrum Disorder: Exploring the Effects of Treatment and
Caregiver Requests

A dissertation proposal submitted in partial satisfaction of the requirements for the degree
Doctor of Philosophy in Education

by

Amanda Marilyn Dimachkie

ABSTRACT OF THE DISSERTATION

Compliance in Toddlers with Autism Spectrum Disorder: Exploring the Effects of Treatment and Caregiver Requests

by

Amanda Marilyn Dimachkie

Doctor of Philosophy in Education

University of California, Los Angeles, 2020

Professor Connie L. Kasari, Chair

Children's ability to comply with caregiver requests is considered to be the earliest indication of self-regulation processes in early childhood and is related to a host of positive future outcomes including social competence, mental health and less parenting stress. The ability to comply with requests may be especially important for children with ASD, who are already pre-disposed to core deficits in social-communication that may make caregiver-child interactions more challenging. Although compliance to caregivers' requests has been studied in children with autism, studies have largely neglected exploring these constructs amongst very young children with ASD. There is also a scarcity of research exploring the effect of early caregiver-mediated intervention on compliance in very young children with autism, an area that warrants more study given the importance of children's compliance for future outcomes. This study is a secondary

data analysis of existing data collected as part of a larger randomized controlled efficacy trial of a naturalistic, parent-mediated social-communication intervention for children with (ASD). The aims of this study are to characterize the use of caregiver requests and children's compliance at entry to the study, explore the effects of treatment on caregiver's use of requests and children's compliance to caregivers' requests over time. Caregiver's requests and children's compliance were coded using videos of dyads completing a clean-up task at three timepoints: entry, exit and 3-month follow-up. Caregiver-mediated intervention (JASPER) increased children's compliance with caregivers' direct requests, but no effect was detected for the effect of treatment on children's compliance with caregivers' indirect requests and caregivers' total requests over time. No treatment effect was found for caregivers' use of direct and indirect requests for participants in either condition. Implications for the contributions of caregiver-mediated treatment and caregivers' use of requests on the development of compliance in very young children with ASD are discussed.

The thesis of Amanda Marilyn Dimachkie is approved.

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- Dimachkie, A.,** Sterrett, K., Baczewski, L., Holbrook, A., Kaiser, A. & Kasari, C. Measuring Executive Functioning Profiles and Development in Young Children with Down Syndrome. Presented at The Gatlinburg Conference on Research and Theory in Intellectual and Developmental Disabilities. San Antonio, TX. April 2019.
- Dimachkie, A.,** Gulsrud, A.C.. & Kasari, Exploring Change in Parent-Child Co-Regulation Over Time in Parents and Toddlers with ASD. Presented at the Society for Research in Child Development Biennial Meeting, Baltimore, MD. March 2019.
- Dimachkie, A.,** Sterrett, K. Gulsrud, A.C. & Kasari, Longitudinal Patterns of Self-Regulation and Maladaptive Behaviors in Children with ASD. Poster presented at the Society for Research in Child Development Biennial Meeting, Baltimore, MD. March 2019.
- Dimachkie, A.,** Gulsrud, A.C., Shih, W. & Kasari, C. Parent-Child Co-Regulation in Toddlers with ASD. Presented at the University of California Center for Research in Special Education, Disabilities, & Developmental Risk Conference, Santa Barbara, CA January 2017.
- Jahromi, L. B. & **Dimachkie, A.** The Importance of Emotion Regulation Coping Strategies and Emotion Knowledge for Social Competence with Peers in Preschoolers with Autism. Poster presented at the International Meeting for Autism Research (IMFAR) Conference, Atlanta, GA May 2014.

Book Chapters and Publications

- Kasari, C., **Dimachkie, A.,** & Pizzano, M. (2020). The Transition to Preschool in Children with Developmental Disabilities. *Policy Analysis for California Education, PACE.*
- Jahromi, L. B., Kirkman, K. S., Friedman, M. A., & **Dimachkie, A.** (*in press*). Associations between Emotional Competence and Prosocial Behaviors with Peers among Children with Autism Spectrum Disorders. *American Journal on Intellectual and Developmental Disorders.*
- Dimachkie, A.,** Kasari, C. Social-Emotional Competence in Down Syndrome (*in press*). In J. Burack, R. Hodapp, G. Iarocci, and E. Zigler (Eds.) *The Oxford Handbook of Intellectual Disability and Development.* New York: Oxford University Press.
- Dimachkie, A.,** Kasari, C. (*in press*). Imitation. F. R. Volkmar (Ed.) *The Encyclopedia of Autism Spectrum Disorders.* Springer.

Manuscripts Revised/Resubmitted and Under Review

- Dimachkie, A.,** Sterrett, K. T., Gulsrud, A.C. & Kasari, C. (revise & resubmit, Autism). What are the odds?: Predicting the likelihood of negative episodes using parent and child behaviors.
- Nuske, H.J., [...], **Dimachkie Nunnally, A.** et al., (Manuscript submitted for publication). Emotion Regulation Skills Predict Friendship Quality in Children with Autis

Introduction

The ability to comply with caregiver requests has long been recognized as a hallmark of childhood development, indicating the emerging development of children's self-regulation capabilities in early childhood (Kopp, 1982; Kim & Kochanska, 2012). Compliance develops during the first few years of life and is thought to be a result of developments in social-cognition and language, as well as the internalization of social expectations through repeated transactional interactions with caregivers (Feldman et al., 1999, Kopp, 1982; Vygotsky, 1978). In addition to shaping children's compliance in early childhood, caregivers can impact children's compliance through their own actions, with caregivers' parenting style, temperament and use of requests being related to compliance in both typically developing children and children with ASD (Crockenberg & Litman, 1990; Maccoby & Martin, 1983; Feldman, Greenbaum, & Yirmiya, 1999; Kochanska, Coy & Murray, 2001; Bryce & Jahromi, 2013). Children's ability to comply with requests is an essential skill in early childhood, as compliance has been associated with a range of positive future outcomes including better caregiver-child relationships, social competence and a decreased likelihood of maladaptive behavior later in life (Kochanska, 2002; Kuczynski and Kochanska, 1990; Patterson, 2002).

While not a core deficit of autism spectrum disorder (ASD), children's non-compliance is one of the primary reasons that caregivers seek clinical help and is a potent contributor to parenting stress (Lecavalier et al., 2006; Plant and Sanders, 2007). The development of compliance appears to take a different trajectory among children with ASD from what is seen among typically developing children, leading to an overall lower level of compliance in comparison with TD peers (Ekas et al., 2017). These differences in compliance in children with ASD has been previously attributed to social-communication deficits recognized to be

characteristic of ASD as well as language difficulties (Arbelle et al., 1994; Lemanek et al., 1993; American Psychiatric Association, 2013), although speculation remains as to the true underlying cause of these differences. Regardless of the cause, the ability to comply with requests may be especially important for children with ASD, who already experience deficits in social communication that can impact social competence and contribute to caregiver stress.

Although compliance to caregivers' requests has been studied in children with autism, studies have largely neglected exploring these constructs amongst very young children with ASD and their caregivers. Additionally, little research has been conducted to elucidate the effect of targeted, caregiver-mediated interventions on caregivers' use of requests and compliance young children with ASD. The current study aims to address this gap in the literature by: a) characterizing caregivers' requests and compliance behaviors in toddlers with ASD during a naturalistic clean-up task, b) exploring the effect of intervention on caregivers' use of requests over time and c) exploring the effect of intervention on children's compliance to requests over time.

Conceptual Framework

Compliance to parental requests has been shown to develop over the first few years of life as a result of a combination of child factors and caregiver-child interactions (Kopp, 1982; Kochanska & Aksan, 1990). In order to address both child factors and parent factors that, through transactional interactions, contribute to the development of compliance in early childhood, I will rely on two conceptual frameworks. Kopp's overview of the development of compliance will be referenced in order to contextualize the typical developmental trajectory of compliance in early childhood, as well as to situate the various child factors that contribute to the

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development of compliance. Vygotsky's Social Development Theory (1978) will also be referenced in order to discuss the contribution of parent-child interactions

Kopp's Overview of the Development of Self-Regulation

Kopp's (1982) Overview of the Development of Self-Regulation outlines the development of compliance in early childhood, drawing heavily upon Piagetan theory (1952), to identify the following developmental antecedents to self-regulation: 1) Neurophysiological Modulation, 2) Sensorimotor Modulation, 3) Control, 4) Self-control and 5) Self-regulation. Although Kopp's overview covers multiple stages that culminate in the development of self-regulation, a focus will be placed on the period referred to by Kopp (1982) as "control", as this is the period within which compliance is thought to develop.

Overview of the Development of Compliance

Beginning as early as nine months of age, infants begin to develop awareness of caregiver demands and to enact the necessary goal-oriented behaviors in order to meet these demands. This developmental phase features what will be later referred to by researchers as compliance, or more specifically situational compliance (Kochanska, 1993). This phase is distinguished from the subsequent phases in that infants rely on external monitoring and direction in order to meet caregiver expectations and have not developed the requisite skills necessary to regulate or modulate their own behaviors. Towards the end of this phase, infants begin to develop the skills necessary for self-initiated monitoring, later termed "committed compliance" by researchers, which is characterized by compliance with expectations without external monitoring. Overall, compliance develops during the first two years of life as a result of development in social-cognition and language (Kopp, 1982) as well reciprocal patterns of communication and interactions with their caregivers (Hubley & Trevarthen, 1979).

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Kopp's Overview of Self-Regulation describes the developmental and cognitive processes that underlie the development of compliance during early childhood. In this framework, Kopp (1982) also acknowledges the importance of social interactions with caregivers throughout development in order to teach, model and scaffold appropriate social behavior for their children, but does not address it in depth. In order to more thoroughly address the role of parent-child interactions in the development of compliance in children with ASD, Vygotsky's Social Development Theory (1978) will be used to compliment Kopp's Overview of Self-Regulation.

Vygotsky's Social Development Theory

The basis of Vygotsky's Social Development Theory is the idea that social-cognitive development occurs through the meeting of "mature cultural forms of behavior with the primitive [i.e. natural] forms that characterize the child's behavior" (Vygotsky, 1981, p.151). Simply put, this theoretical perspective proposes that children's behavior is transformed through contact with more socially mature social partners (i.e. their caregivers). Vygotsky's theory relies on two underlying principles: 1) Cognitive development is limited to a certain range at any given age and 2) Full cognitive development requires social interaction (Vygotsky, 1978). When applied to the development of compliance, Vygotskian theory highlights two formative factors. First, that children's cognitive abilities must be a consideration when parents use scaffolding techniques to facilitate the development of compliance behavior. Second, in order to achieve optimal development of compliance, children must be exposed to social learning opportunities in the form of parent-child interactions.

In order to truly conceptualize the way that children develop compliance behaviors, attention must be paid to individual child factors in the larger context of repeated parent-child

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interactions. Kopp's Overview of the Development of Self-Regulation will allow for a conceptual understanding of the various developmental and cognitive factors that contribute to children's development of compliance. This development is further situated by incorporating Vygotsky's Social Development Theory (1978), which accounts for the transactional parent-child interactions which contribute to shaping the development of children's compliance. Together, these theoretical frameworks offer a multifaceted perspective on the development of compliance in early childhood.

Caregivers' Use of Requests During Early Childhood

The ability to comply with parental requests, and to regulate behavior on a larger scale, is not developed in a vacuum, rather as a result of repeated interactions between infants and their caregivers (Feldman et al., 1999; Kopp, 1982). This view is pervasive in the literature, suggesting that children's ability to adhere to rules of conduct and to engage in behavior regulation is largely formed from repeated, dialogic interactions with their caregivers (Emde, 1992; Kochanska, 1991, 1993; Van IJzendoorn, 1997). When caregivers make requests of their children during daily interactions, they give children the opportunity to engage in behavior regulation (Feldman, Greenbaum & Yirmiya, 1999), the opportunity to internalize prosocial behavior (Kochanska, 2002) and facilitate the coordination of intentions and actions to meet social expectations (Dix & Branca, 2003). These interactions over time contribute in no small part to children's development of compliance.

Researchers have identified factors related to caregiver-child interactions that appear to encourage the development of child compliance. These include parenting style that is responsive to child cues and places warm and consistent limits (Crockenberg & Litman, 1990; Maccoby & Martin, 1983; Feldman, Greenbaum, & Yirmiya, 1999; Kochanska & Murray, 2000). The

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behaviors described above draw heavily upon Vygotskian tenets of socialization (Vygotsky, 1978), which propose that children learn through interactions with caregivers in which parents are attuned to children's needs, provide support when needed and promote learning for scaffolding techniques. Additionally, these behaviors also encourage an awareness and responsiveness to children's cues, which includes tailoring their behavior to meet children's developmental abilities (Feldman et al., 1999; Kopp, 1982).

Direct and Indirect Caregiver Requests

Caregivers can use a range of requests strategies to elicit compliance from their toddlers, the most common of which are **direct and indirect requests**. These types of requests can be distinguished primarily by the type of language used. While direct requests are characterized by explicit direction (i.e: "give me the ball"), indirect requests are recognized to be less directive and more suggestive (i.e: "where should the ball go?"; Kuczynski and Kochanska, 1995). Studies of TD children's compliance to caregiver requests during clean-up paradigms have shown similar trends of caregiver behavior. One study of typically developing children ($M_{age} = 30$ months) and their parents found that caregivers used a higher proportion of control requests (comparable with direct requests) than guidance requests (comparable to indirect requests) during a clean-up paradigm (Braungart-Rieker, Garwood & Stifter, 1997). Interestingly, caregivers' use of strategies in this sample was associated with the level of sophistication of children's compliance behaviors, such that the use of more developmentally sophisticated behaviors such as committed compliance and self-assertion was related to less control strategies (i.e: direct requests). This finding echoed earlier findings of a preponderance of direct requests used by caregivers of toddlers during a clean-up task (Smith et al., 2004), although correlates of caregiver behaviors were not reported for this study. Caregivers' use of strategies has also been

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found to be related to children's problem behaviors, with caregivers of children who were rated as having more behavioral problems using more control strategies and fewer guidance strategies (Braunger-Rieker, Garwood & Stifter, 1997; Gardner, 1994, Smith et al., 2004). Altogether, caregivers of TD appear to modulate their use of requests based on children's sophistication of compliance behaviors as well as their maladaptive behaviors.

Caregivers' Use of Requests with Young Children with ASD

Compliance in children with ASD is developed via the same mechanisms as in TD children: through repeated parent-child interactions. The difference between eliciting compliance from children with ASD appears to lie in the strategies that parents use to request compliance, rather than the mechanism through which compliance is learned. Of the few studies exploring compliance to caregiver's requests in early childhood, only one reported on caregiver behaviors, with the rest placing an emphasis solely on children's compliance behaviors. In a study exploring compliance to caregiver requests among preschoolers ($M_{age} = 58.95$ months), researchers found that caregivers used a higher proportion of indirect requests than direct requests (Bryce & Jahromi, 2013). This is contrary to findings using similar paradigms with TD children, showing that caregivers of TD children predominantly use direct requests in the context of a clean-up task (Braunger-Rieker, Garwood & Stifter, 1997; Gardner, 1994, Smith et al., 2004). The paucity in the literature makes it difficult to characterize caregivers use of requests with young children with ASD, revealing the need for a better understanding of how caregivers use request strategies with toddlers with ASD.

Children's Compliance to Caregiver Requests in Early Childhood

Development of Compliance in Typically Developing Children

Children's ability to comply with parental requests begins to develop at 9 – 12 months of age, a period marked by an awareness of social expectations and the ability to monitor and modify behaviors in order to meet said expectations (Kopp, 1982). This developmental stage is believed to occur as a result of cognitive changes including the emergence of problem-solving (Piaget, 1954) and cognitive flexibility (Diamond, 2002). It is the combination of this cognitive growth and developments in children's language abilities that allows infants to begin exhibiting compliance behaviors (Kopp, 1982). At first, infants begin exhibiting situational compliance, such as responding appropriately to parent directives such as "come here". In these instances, infants show awareness and understanding of their parents' expectations and engage in the necessary behaviors in order to meet these expectations. At approximately 18 months of age, children undergo changes in cognitive abilities to engage in a more sophisticated form of compliance: committed compliance, reflecting infants' internalization of social expectations and the ability to make the necessary choices to adhere to these expectations. Overall, compliance behaviors in typically developing children begin to increase between 14 months and 33 months of age and stabilizes after the age of 45 months (Kochanska & Aksan, 1995; Kochanska et al., 2001).

In conjunction with developments in compliance behaviors, an evolution in noncompliant behaviors also occurs during this time. Noncompliant behaviors before the age of 2 years are largely unstable and largely uncorrelated with noncompliance after the age of 2 years (Calkins, 2002). During these first two years, children are most likely to use passive noncompliance when choosing not to comply with parents' requests. The use of passive noncompliance has been found to decrease between the ages of 15 months and 60 months among typically developing children and is thought to be the least sophisticated of the forms of non-compliance (Kuczynski

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& Kochanska, 1990). This decrease seems to occur concurrently with an increase in other noncompliant behaviors, namely defiance and overt assertion, which occurs between 14 and 27 months (Dix et al., 2007). These changes in noncompliant behaviors occur in part as a matter of development, not solely socialization, which speaks to a unique developmental trend in noncompliant behaviors in addition to compliant behaviors.

Researchers have presented mixed findings regarding whether noncompliance in early childhood is exclusively associated with poor outcomes or a sign of children's developing sense of self.

Since noncompliance prior to the age of 2 years is unstable, it is not predictive of future child outcomes (Calkins, 2002). Some researchers have found that, after the age of 2 years, resistance to parents' requests have been associated with poor social competence, poor internalization of prosocial values and poor parent-child relationships (Kochanska, 2002; Kuczynski & Kochanska, 1990; Patterson & Fisher, 2002). Other researchers have posited that some resistance to parental requests can reflect children's attempts to assert themselves and develop a sense of autonomy, which is a necessary milestone in child development (Erickson, 1963; Kopp, 1982). It has been suggested that some forms of resistance, such as self-assertion or negotiation without overt negativity, are developmentally appropriate and increase with age before decreasing around 36 months of age (Kuczynski & Kochanska, 1990; Dix et al., 2007). Other forms of noncompliance, namely passive noncompliance or defiance with negativity, in TD children may be indicative of a delay in the development of compliance or of overly controlling parent-child interactions (Braungart-Rieker, Garwood & Stifter, 1997; Dix et al., 2007).

Compliance to Direct and Indirect Requests in Typically Developing Children

Studies have shown temporal associations between children's compliance with caregivers' requests and caregivers' use of request strategies. Studies suggests that parents who used direct requests, as opposed to indirect requests, were more likely to be met with increased noncompliance and decreased committed compliance (Braungart-Rieker et al., 1997). Similarly, a number of studies have presented findings suggesting that the use of indirect requests by parents was associated with higher levels of compliance from their TD children (Kuczynski & Kochanska, 1990; Wachs et al., 2004). One explanation for this phenomenon is that TD children may be more compliant to indirect requests because they are more sensitive and less controlling than direct requests, leading to a less stressful situation (Braungart-Rieker et al. 1997; Kuczynski and Kochanska 1995). A second explanation is that, by using indirect commands parents are being more sensitive to their children's developing sense of autonomy, which then is met with less resistance from their child (Kuczynski et al., 1987).

Development of Compliance in Children with ASD

Although there appears to be an established developmental trajectory for compliance behaviors in typically developing children (Kochanska, Coy, & Murray, 2001; Kuczynski & Kochanska, 1990), children with ASD have been found to deviate from this recognized developmental trajectory. Several studies of children with ASD (CA = 3 – 6 years) have reported findings that children with ASD are more likely to display non-compliance, specifically passive non-compliance (i.e: a lack of acknowledgement of the request), than their MA-matched TD peers (Bryce & Jahromi, 2013; Ostfeld-Etzion et al., 2016) and MA-matched peers with intellectual disabilities and language impairments (Lemanek et al., 1993). A later study comparing children at high risk and low risk for ASD with a comparison group of TD children at three timepoints (CA = 24, 20 and 36 months), found that children at high risk for ASD (who

subsequently receive a diagnosis) showed higher levels of passive noncompliance and lower levels of active noncompliance than those at low risk of ASD (Ekas et al., 2017). This study also found that high-risk children with ASD outcomes showed less growth in compliance behaviors over time than high-risk children without ASD outcomes, suggesting that children with ASD may follow a different developmental trajectory than TD children (Dix et al., 2007). Researchers have theorized that this divergence from normative patterns could be attributed to possible difficulties in inferring others' intentions and perspectives in individuals with ASD in combination with delays in language and social communication (Bryce & Jahromi, 2013; Paul and Cohen, 1985). The findings of increased passive non-compliance among children with ASD is particularly interesting as it may be indicative of a delay or divergence from the typical trajectory of compliance in early childhood, as passive non-compliance is considered the least developmentally sophisticated form of non-compliance. In typically developing children, passive non-compliance tends to decrease in passive non-compliance between 30 – 36 months, while toddler with ASD, on the other hand, appear to *increase* in these behaviors during this time (Ekas et al., 2017).

In addition to differences between children with ASD and TD populations, there is evidence of further variability within children with ASD. In the aforementioned longitudinal study by Ekas and colleagues (2017), comparing compliance behaviors in toddlers (CA = 24, 30 & 36 months) who are at high-risk for ASD, low-risk for ASD, and TD children, findings revealed that for children who went on to receive a diagnosis of ASD, group differences in passive but not active noncompliance appeared to be in part due to receptive language differences (Ekas et al., 2017). This suggests that children who would be categorized as at a higher developmental age seem to exhibit different patterns of compliance than those that would

be categorized as lower developmental age. These findings echo earlier results of a study comparing compliance behaviors in children (CA = 3-6 years) with ASD, intellectual disabilities, language delays and TD children, which revealed that children who have been categorized as having a higher developmental age were less likely to display noncompliance and leave-taking than children who have been categorized as lower developmentally (Lemanek et al., 1993). A third study, comparing a matched sample of typically developing children (CA = 50.2 months) and children with high ability ASD (CA = 58.95 months) on compliance to parental requests, found that children with less severe autism symptomatology showed significantly more noncompliance and less compliance than their TD counterparts (Bryce & Jahromi, 2013). This pattern reveals that although variation in compliance appear to exist between children with ASD (dependent upon symptom severity), children with ASD still display different trends of compliance than MA-matched typically developing children.

Compliance to Direct and Indirect Requests in Young Children with ASD

Just as with TD children, it appears that compliance to parental requests in children with ASD is strongly related to parental strategy use. Whereas TD children tend to respond to indirect commands with increased compliance, and to direct commands with noncompliance, children with ASD tend to exhibit an opposite behavioral trend. In a study comparing children with ASD (CA = 34 – 75 months) with matched samples of children with ID of mixed etiology and TD children, findings revealed that children with ASD showed less compliance to indirect requests than TD children or children with intellectual disabilities (Sigman et al., 1986). A study by Bryce and Jahromi (2013) presented the same trend, with children responding to indirect requests with increased noncompliance and decreased compliance in comparison with TD children. No other studies have explored the relationship between caregivers' use of direct and indirect requests on

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compliance in children with ASD, with most placing a focus on caregivers' disciplinary style, parenting style and temperament (O'Nions et al., 2018; Ostfeld-Ozion et al., 2016; O'Nions et al., 2020), revealing a gap in the scope of the literature.

Interventions Targeting Compliance in Children with ASD

Children's non-compliance has been among the top behavioral issues reported by caregivers of children with ASD (Ekas & Whitman, 2010), which has led to a range of approaches used to manage children's non-compliance. The most common approach that has been used to address noncompliance in children with ASD is behavioral intervention, a type of child-centric intervention based on applied behavioral analysis (ABA) which uses learning principles to teach social and living skills in real-life settings (Smith, 2012). Although ABA-based interventions have shown success in clinical settings, issues with costliness, generalization and maintenance (Schreibman, 2000; Smith et al., 2007; Lovaas et al., 1973) have driven the field towards more naturalistic behavioral approaches that include the caregiver as an active participant.

Parent training and education. An example of such an approach is Parent Training (PT) or Parent Education (PE), which focuses on the caregiver as the agent of change by training them on behavior management, anxiety management, functional communication training, social skills training and information on core symptoms of ASD (See Postorino et al., 2017 for a systematic review of parent training approaches). Results of a recent meta-analysis by Postorino and colleagues (2017) found that PT approaches can be successful in improving children's disruptive behaviors, with only one study reporting an association between parent training and improvements in noncompliance (Bearss et al., 2013).

Naturalistic developmental behavioral interventions (NDBIs). Another example of such an approach is a category of interventions referred to as Naturalistic Developmental Behavioral Intervention (NDBI), which are characterized by a strong emphasis on employing both developmental and behavioral strategies targeting children's individual developmental needs. NDBIs are administered in naturalistic contexts, such as during play interactions, allowing for the interventionist to follow children's lead and provide natural reinforcement.

Only once study to date has explored the effect of play-based caregiver mediated intervention on compliance in children with ASD, albeit with its limitations. Zlomke and colleagues (2017) conducted a pilot study to assess the preliminary effectiveness of Parent Child Interaction Therapy (PCIT; Eyberg, Boffs & Algina, 1995; McNeil & Hembree-Kigin, 2010) on compliance behaviors in children with ASD (n = 17; CA = 2 – 8 years). PCIT is an established play-based caregiver-mediated intervention targeting disruptive behavior in typically developing young children, although it has been used with children with ASD and intellectual disability (Bagner & Eyberg, 2007; Solomon et al., 2008). Children in the study improved over the course of the study in their compliance behaviors, as measured by observational coding of naturalistic caregiver-child interactions (The Dyadic Parent-Child Interaction Coding System, DPICS-III; Eyberg et al., 2005). Given the small sample size, and the wide range of ages represented in the sample, the findings of this study cannot be considered conclusive, but nonetheless indicate that further study is needed to understand how play-based caregiver-mediated intervention impacts compliance behavior amongst children with ASD.

Current Study

The important contribution made by caregivers to children's development has long been studied (Piaget, 1952, Vygotsky, 1978, Kopp, 1982), placing emphasis on scaffolding

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development by being aware of and responsive to children's individual developmental and cognitive abilities. Children's compliance develops primarily as a result of children's developmental and cognitive abilities and repeated caregiver-child interactions over time. Optimizing caregiver-child interactions to be responsive to children's developmental and cognitive abilities may be especially important for children with ASD. By using appropriate developmental and behavioral strategies, caregivers may be able to facilitate children's development of compliance over time. Additionally, targeting the underlying core deficits associated with ASD, namely social-communication deficits, may have a positive impact on children's compliance to caregivers' requests, as it may improve children's ability to interpret and respond to caregivers' requests.

This study examines caregivers' use of request strategies and children's compliance with requests prior to receiving intervention. Next, this study will examine the comparative effects of a caregiver-mediated play-based NDBI (JASPER) and a caregiver psychoeducational intervention on caregivers' use of requests and children's compliance with caregivers' requests. The aims of this study are as follows:

Aim 1: Characterize children's compliance and caregivers' use of requests at baseline.

Aim 2: Examine the effect of treatment on caregivers' use of requests over time.

(a) Examine the effect of treatment on caregivers' proportion of direct requests over time.

(b) Examine the effect of treatment on caregivers' proportion of indirect requests over time.

Aim 3: Examine the factors that contribute to children's compliance with caregivers' requests at exit and 3-month follow-up

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- (a) Examine the effect of treatment on children's proportion of compliance to caregivers' direct requests over time.
- (b) Examine the effect of treatment on caregivers' proportion of compliance to caregivers' indirect requests over time.

Methods

Participants

Participants were recruited as part of a larger RCT of a parent-mediated naturalistic social-communication intervention for children with ASD (JASPER; Kasari et al., 2015). Participants were recruited from the same 10-week outpatient early intervention (EI) program, consisting of a combination of behavioral, speech, and occupational therapies for a total of 30 hours a week. A University Institutional Review Board gave approval for the study and caregivers provided written consent for their participation. Children were included in the study if they were younger than 36 months, had a clinical diagnosis of ASD confirmed by independent testers with the Autism Diagnostic Interview-Revised (ADI-R; Lord, Storoschuk, Rutter, & Pickles, 1993) and the Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavore, & Risi, 2000), had no significant physical disabilities, and parent and child were available for follow-up assessments.

A total of 86 parent-child dyads enrolled in the study from January 2007 to September 2012 and were subsequently randomized to receive either a psychoeducational intervention (PEI) or a parent-mediated intervention (JASPER). Of the 86 participants originally enrolled in the study, 75 were included in this secondary data analysis. Participants were excluded from this study if: a) had missing data for the cleanup task at two or more timepoints ($n = 10$) or b) did not complete the task in English ($n=1$).

The resulting sample for this study included 39 participants in the JASPER treatment group and 36 participants in the PEI treatment group. Of this sample, participants identified as Caucasian (60%) Asian (12%), Hispanic (8%), African American (2.7%) and Other (17.3%). Children in the sample were on average 31.48 months old ($SD = 3.240$) and, in keeping with prevalence rates of ASD, mostly male (82.70%). Using the Mullen Scales of Early Learning (MSEL, Mullen, 1995), children were found to have, on average, a receptive language age equivalent of 14 months ($SD = 10.531$) and an ADOS Severity score of 6.00 ($SD = 2.085$) at baseline. See Table 1 for details.

Caregivers in the sample were on average 35.64 years old ($SD = 4.462$), and the majority indicated that they had attained some post-secondary education. Of the caregivers in the sample, 2.70% were high school graduates, 16% had attended some college, 2.70% had received vocational training, 46.70% graduated college and 32% had attained a graduate degree. See Table 2 for details.

Comparisons of the participants in the two randomized treatment groups revealed that the groups were not significantly different with the exception of child's age entry (Table 3 & Table 4). Children in the parent education group ($M_{\text{age}}=32.39$ months, $SD=2.611$) were found to be significantly older than children in the parent intervention group ($M_{\text{age}}=30.64$ months, $SD=3.558$), although the magnitude of the difference is negligible. Groups were also similar in the total time needed (in seconds) to complete the clean-up task at baseline. Lastly, children in both groups continued receiving early intervention services in the period between exit and 3-month follow-up, with comparisons revealing no significant group differences ($t(66) = 0.67$, $p = .947$) in service utilization (hours per week) between children in JASPER ($M_{\text{Hours/Week}} = 40.32$, $SD = 23.39$) and those in PEI ($M_{\text{Hours/Week}} = 40.72$, $SD = 126.85$).

Procedures

75 (of 86) toddlers with ASD (24 – 36 months) were asked to complete a cleanup task with their caregiver at three timepoints: entry, exit and 3-month follow-up. Interactions were videotaped and later coded in 10-second intervals for types of caregiver requests and children's compliance to caregiver requests. In addition to completing the aforementioned tasks, children also completed the MSEL (Mullen, 1995) and the Autism Diagnostic Observation Schedule (ADOS, Lord et al., 2012), which were administered to them by assessors trained to reliability. Assessments and tasks were either conducted at the research laboratory or at the participants' home, dependent upon the needs of the participant.

Intervention

Participants in both treatment conditions received a total of one hour of intervention with trained interventions over the course of the 10-week study.

JASPER

Caregivers who were assigned to the caregiver-mediated intervention group received weekly one-to-one coaching on JASPER, a targeted social communication intervention that focuses on children's spontaneous initiations of social communication gestures, language and play acts (Kasari et. al., 2006; Kasari et al., 2014; Kasari, Paparella, Freeman & Jahromi., 2008; Kasari et al., 2010; Kasari, Gulsrud, Freeman, Paparella & Hellemann, 2012; Lawton & Kasari; 2012). Intervention took place twice a week (30 minutes per session) in the presence of the child, allowing the opportunity for the interventionist to provide hands-on coaching. Over the course of the study, caregivers in the JASPER group were taught to: a) identify their child's use of social-communication gestures, language and play level b) implement strategies to encourage joint engagement, increase use of social-communication gestures and language. Coaching followed a

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structured schedule which had been previously tested and was tailored to each child's individual needs (Kasari et al., 2010; 2014).

Parent Education Intervention (PEI)

Caregivers in the psychoeducation intervention group received a caregiver psycho-educational intervention using a manualized protocol (Brereton & Tonge, 2005) which covered specific autism-related topics each week with the aim of providing education and support to caregivers of young children with ASD. Interventionists had weekly, hour-long sessions with caregivers, during which they covered a specific topic and allowed caregivers to ask questions specific to their own child's development directly to their therapist. Among the topics discussed over the course of the intervention were: general information on ASD, principles of behavior management, strategies for teaching new skills, approaches to improving social communication, accessing available services, managing caregiver stress, and discussions of family and community responses to ASD.

Clean-Up Task

At baseline, exit from intervention, and at a 3 month follow up, parents were asked to play with their children for 10 minutes using a standardized set of toys. Immediately following this naturalistic play interaction, caregivers and their children were asked to complete a clean-up task. During this task, caregivers were instructed to encourage their child to assist them with cleaning up toys used in the play interaction by putting them into a provided bin. Parents were not given any instruction on how to interact with their child. The task ended either after 3-minutes or when the dyads finished placing all the toys in the bin.

Coded Measures

Prior to coding, videos were given randomized IDs in order to ensure that coders were naïve to timepoint. Coding was performed by a team of coders trained to reliability ($ICC > 0.80$) by the first author. The first author was not involved in the overall coding in order to minimize bias. In order to maintain reliability, 20% of videos were double coded over the course of the coding period, meeting the threshold of reliability ($ICC > 0.80$).

Children's Compliance

Children's compliance was coded using an adaptation of the protocol used in a study of compliance in typically developing children and their parents (Kochanska & Aksan, 1996). Whereas the original protocol differentiates between two types of compliance (committed versus situational), the protocol used in this study combined the two types of compliance to create an overarching compliance code. This adaptation was made to accommodate the developmental level of the participants, as well as the nature of the task. Videos of the clean-up task were coded, using the adapted protocol, for the presence of four child behaviors:

- 1) Compliance: Overarching code to indicate child's compliance with the caregiver's request. This code encompasses both committed compliance (fully endorsing or embracing the caregiver's agenda as their own) and situational compliance (insincere commitment, maintained by caregiver's sustained control).
- 2) Passive Non-Compliance: This code is used when the child is not receptive to the caregiver's agenda but does not offer overt resistance. This may manifest as a lack of acknowledgement of the caregiver's request.
- 3) Self-assertion: This code reflects a child's overt rejection of their caregiver's request, accompanied with the assertion of their own agenda. This behavior is characterized

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by a lack of negative affect. Examples include a child informing their caregiver that they would like to continue playing instead.

- 4) Defiance: This code indicates a child's overt rejection of their caregiver's request, paired with negative affect. Examples include yelling, whining or crying.

Children's compliance is only coded subsequently to a request, such that a compliance score of 1 indicates compliance to all requests, and a compliance score of 0 would indicate no compliance to requests.

Type of Caregiver Request

Videos of the clean-up tasks were coded using codes drawn from a protocol used previously with children across populations, including children with ASD (Bryce & Jahromi, 2013). Prior to coding, videos were given randomized IDs in order to ensure that coders were naïve to timepoint. Videos were coded in 10-second intervals to indicate whether caregivers predominantly used:

- 1) Direct requests: This code indicates the use of explicit verbal statements, nonverbal gestures specifying the action desired of the child, or a combination of both. The defining feature of a direct request is the lack of ambiguity in the directive given to the child. Examples: "Please put the ball in the box", "Give me the block", "Put the ball *in* (paired with point to the box)".
- 2) Indirect requests: This code indicates the use of unclear or ambiguous requests which are lacking in a specified action, a specified referent or both. Examples: "Does the ball want to go in the box?", "How do we clean up?", "Come on, help mommy".

Caregivers' use of requests was coded for majority per interval. In the event that caregivers used both types of requests during an interval, the interval is coded for the request that accounted for the majority of the interval.

Measures

Autism Diagnostic Observation Schedule (ADOS)

The Autism Diagnostic Observation Schedule is a semi-structured, standardized play-based assessment used to diagnose ASD. For the purposes of this study, a calibrated severity score (ADOS Severity Score) was calculated for participants to provide a standardized score for symptom severity (Gotham, Pickles & Lord, 2009).

Mullen Scales of Early Learning (MSEL)

The Mullen Scales of Early Learning (MSEL; Mullen, 1995) is a standardized developmental test designed for use with children between the ages of 30 and 60 months. The assessment is comprised of 5 subscales: gross motor, fine motor, visual reception, expressive language, and receptive language. This assessment provides standard verbal and nonverbal summary scores, as well as age equivalents for receptive and expressive language. The assessment was conducted by trained assessors in accordance with standardized instructions.

Outcome Measures

Prior to calculating caregivers' proportions of requests and children's proportions of compliance with caregivers' requests, distributions of children's compliance and caregiver's frequency of requesting were checked and found to approximate a normal distribution. The resulting children's compliance score was also found to approximate a normal distribution, although slightly skewed. Distribution statistics for skewness and kurtosis indicated that the distributions fell within the range of normal distribution and could be treated as such in analyses.

Caregivers' proportion of requests and children's proportions of compliance with caregivers' requests were calculated for entry, exit and 3-month follow-up.

Proportion of Caregivers' Requests

Proportion of direct requests. The proportion of direct requests used by caregivers was calculated by dividing the number of direct requests made by the total number of requests made during the task (direct requests / total requests).

Proportion of indirect requests. The proportion of indirect requests used by caregivers was calculated by dividing the number of indirect requests made by the total number of requests made during the task (indirect requests / total requests).

Proportions of Children's Compliance

Proportion of compliance to direct requests. The proportion of direct requests to which children responded to with compliance was calculated by dividing the number of times the child complied with a direct request by the total number of direct requests made by caregivers (compliance to direct requests / total direct requests).

Proportion of compliance to indirect requests. The proportion of compliance to indirect requests, this variable was calculated by dividing the number of times the child complied with an indirect request by the total number of indirect requests made by caregivers (compliance to indirect requests / total indirect requests).

Proportion of overall compliance to caregiver's requests. This variable quantifies the ratio of children's overall compliance to caregiver's requests to the total number of caregiver requests made and is meant to reflect how compliant a child was during the given task (Bryce & Jahromi, 2013; Ekas et al., 2017). Children's proportion of overall compliance was calculated by

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dividing the frequency of children's compliance to caregivers' requests by the total number of requests made by caregivers (children's overall compliance/total requests).

Data Analysis

Preliminary analyses were conducted in order to test whether data meets the necessary assumptions GLMM and was found to not violate assumptions.

Aim 1: Characterize children's compliance and caregivers' use of requests at baseline.

Independent samples t-tests and chi-squared analyses were conducted in order to compare participants across treatment groups at baseline for: child demographic variables (chronological age, ADOS Severity, ethnicity), children's compliance and caregiver's requesting. Due to low incidence, self-assertion and defiance were excluded from analyses. Next, bivariate and partial correlations were used to examine associations between baseline caregiver requests and children's compliance, controlling for children's chronological age, receptive language age equivalent and ADOS Severity score.

Aim 2: Examine the effect of treatment on caregivers' proportions of requests over time.

Two separate GLMMs were conducted to examine the effect of treatment on caregivers' proportion of direct requests and proportion of indirect requests over time. Fixed effects for both models included treatment group, timepoint, as well as an interaction term between timepoint and treatment group to account for the contribution of treatment over time. The model also accounted for possible confounding variables including child's chronological age, ADOS Severity score, child's receptive language age equivalency and the total time (seconds) taken to complete the task. Lastly, a random effect for intercept was added to the models in order account for baseline differences.

Aim 3: Examine the effect of treatment on children's proportion of compliance with caregivers' requests over time

Separate GLMMs were conducted to examine the effect of treatment on the proportion of children's compliance to caregivers' direct requests and to indirect requests. Fixed effects for both models included treatment group, timepoint, as well as an interaction term between timepoint and treatment group to account for the contribution of treatment over time. The model also accounted for possible confounding variables including child's chronological age, ADOS Severity score, child's receptive language age equivalency and the total time (seconds) taken to complete the task. The model predicting change in proportion of compliance to direct requests included an additional variable controlling for children's baseline proportion of compliance to direct requests due to baseline differences. Lastly, a random effect for intercept was added to the models in order account for differences at baseline.

Results

Aim 1: Characterizing Caregiver's Requesting and Children's Compliance at Baseline

Characterizing Caregiver's Requests at Baseline

At baseline, caregivers made an average of 8.39 requests ($SD = 4.71$) of their child during the clean-up task, with an average of 2.89 direct requests ($SD = 3.12$) and 5.85 indirect requests ($SD = 3.12$). Caregivers had an average proportion of direct requests (direct requests / total requests) of 0.29 ($SD = 0.26$) and an average proportion of indirect requests (indirect requests / total requests) of 0.70 ($SD = 0.27$).

Group differences in caregiver's requests. Independent samples t-tests were also conducted to compare caregivers on the frequency of their requesting behaviors at entry (see Table 6). Caregivers in the PEI and JASPER groups were not significantly different in the

frequency with which they used direct requests ($t(72) = -.008, p = .994$) and indirect requests ($t(72) = .026, p = .979$), nor were they different in the total number of requests ($t(72) = .121, p = .904$) they used during the task. Caregivers were also similar in the proportion of direct requests ($t(71) = 0.60, p = .548$) and indirect requests ($t(72) = -0.36, p = .721$) at baseline (see Table 8).

Associations between frequency of caregiver's requests and children's compliance behaviors. Partial correlations were conducted in order to determine the association between the frequency caregiver's requests and the frequency of children's compliance behaviors at baseline, while controlling for children's age, receptive language age equivalent and ADOS Severity score (see Table 9). The frequency of caregiver's use of direct requests was positively associated to both children's compliance ($r = .364, p = .003$) and passive non-compliance ($r = .336, p = .006$), while the frequency of caregiver's use of indirect requests was positively associated with children's passive non-compliance ($r = .348, p = .004$) and defiance ($r = .363, p = .003$). Caregivers' proportion of indirect requests used at baseline was significantly and positively related to children's ADOS severity score ($r = .265, p = .025$). No association was found between caregivers' use of direct requests and children's characteristics at baseline.

Characterizing Children's Compliance Behaviors at Baseline

At baseline, children were found to respond to caregiver requests with compliance an average of 3.77 times ($SD = 3.606$) and passive non-compliance an average of 3.84 times ($SD = 3.993$) over the course of the task ($M_{seconds} = 95.23, SD = 53.20$). On average, children's proportion of compliance to direct requests (compliance to direct request/total requests) was 0.48 ($SD = 0.42$) and their proportion of compliance to indirect requests (compliance to indirect request/total requests) was 0.39 ($SD = 0.35$). Children's overall compliance score (total

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compliance/total requests) was 0.45 ($SD = 0.33$), meaning they responded to their parents requests less than half the time.

Group differences in children's compliance behaviors at baseline. Independent samples t-tests were conducted to determine whether group differences exist at baseline for the frequency of children's compliance behaviors. Analyses revealed that children were not significantly different across groups on frequency of compliance ($t(72) = .108$, $p = .707$) although children in the JASPER group exhibited significantly less passive non-compliance ($M_{\text{PassiveNoncompliance}} = 3.32$, $SD = 3.231$) than the children in the PEI group ($M_{\text{PassiveNoncompliance}} = 4.31$, $SD = 4.63$) at baseline ($t(72) = 1.071$, $p = 0.015$). There was no significant differences between groups for the average length of time taken by the child to complete the task ($t(72) = .249$, $p = .804$).

A significant group difference was found for children's proportion of compliance with direct requests at baseline, with children in the JASPER condition exhibiting a significantly lower proportion of compliance to direct requests than children in the PEI condition, but the same was not found for the proportion of compliance to indirect requests ($t(72) = 0.04$, $p = .966$). Children's overall compliance score (frequency children's compliance/frequency of caregiver requests) was also compared across treatment groups and no significant difference emerged ($t(71) = 0.86$, $p = .932$).

Associations between children characteristics and compliance behavior. Frequency of children's compliance at baseline was found to be associated with children's receptive language age equivalent (MSEL) and ADOS Severity Score. Children's compliance to caregiver's requests ($r=0.309$, $p = 0.007$) was positively correlated with their receptive language abilities, where higher receptive language age equivalents were associated with a higher

frequency of compliance. Children's passive non-compliance was not significantly associated with children's characteristics at baseline, nor were children's proportion of compliance to direct requests and indirect requests (see Table 10).

The Effect of Treatment on Caregiver's Requests Over Time

The effect of treatment on caregivers' use of direct requests over time. Results of a GLMM examining the effect of treatment on the proportion of caregivers' direct requests over time revealed no significant main effects ($F(1,187) = 1.48, p = .232$; table 14).

The effect of treatment on caregivers' use of indirect requests over time. No significant main effects were found for the effect of treatment on caregivers' proportion of indirect requests over time ($F(1,188) = 1.03, p = .359$; table 16).

The Effect of Treatment on Children's Compliance to Caregivers' Requests

The effect of treatment on children's proportion of compliance to caregivers' direct requests. Results of the GLMM revealed a significant main effect for the interaction between treatment and time on children's proportion of compliance to direct requests over time ($F(1,112) = 3.20, p = .045$; table 18). Post-hoc analyses indicate significant increases in children's proportion of compliance to direct requests at exit and 3-month follow-up for participants in the JASPER condition, but no significant differences were detected for participants in PEI (see Table 120).

The effect of treatment on children's proportion of compliance to caregivers' indirect requests. No significant main effects were found for the effect of treatment on children's proportion of compliance to indirect requests over time ($F(2,184) = 0.819, p = .443$, Table 21).

The effect of treatment on children's proportion of overall compliance to caregivers' requests. There was no significant main effect of treatment on children's overall compliance to caregivers' total requests over time ($F(2,185) = 0.488, p = .615$, Table 23).

Discussion

The current study is a secondary data analysis of data collected as part of a larger RCT of a naturalistic, caregiver-mediated social-communication intervention for children with ASD (JASPER). This study aims to characterize the relationship between children's compliance and caregiver's use of requests at baseline and explores the effect of treatment on caregivers' use of requests and children's compliance score over time. An emerging profile of caregiver's use of requests and children's compliance behaviors at baseline is described, and the contribution of treatment to care children's compliance score over time is discussed.

Caregiver's Use of Requests at Baseline

The frequency and proportions with which caregivers used direct and indirect requests at baseline was examined in order to better understand how caregivers' requests were associated with children's compliance prior to receiving intervention. Results indicate that caregivers in this sample used a much higher proportion of indirect requests than direct requests at entry, and that use of requests was unrelated to children's individual characteristics, specifically chronological age, receptive language and ADOS Severity score. One other study has examined caregiver's use of indirect and direct requests with their children with ASD using a sample of preschoolers with high-functioning autism (HFA; Bryce & Jahromi, 2013), although direct comparisons are difficult due to differences in coding protocol. Consistent with findings of this study, Bryce and Jahromi (2013) reported that parents in their sample also used indirect requests most frequently, and that parents of children with HFA did not differ significantly from TD children in their use of requests. This finding is of interest since it may indicate that caregivers of toddlers with ASD are not modulating their use of request strategies to children's developmental and cognitive abilities.

Associations were found between the frequency of caregiver use of requests and the frequency of children's compliance behaviors at baseline, controlling for children's characteristics. The frequency with which caregivers used direct requests was associated with both children's compliance and, to a slightly lesser magnitude, passive non-compliance. Caregiver's frequency of indirect requests was associated with the frequency of children's passive non-compliance but there was no association with the frequency with which children complied. The trend of indirect requests being associated with noncompliance and direct requests being related to compliance is consistent with previous findings of studies using samples of children with ASD (Sigman et al., 1986; Bryce & Jahromi, 2013), adding to the growing base of evidence of the association between these caregivers' use of indirect requests and children's passive non-compliance.

Children's Compliance Behaviors at Baseline

This baseline profile of children's compliance shares similarities and differences to prior studies. The finding that children in this sample most frequently responded to requests with passive non-compliance is consistent with previous findings that children with ASD exhibit a high incidence of passive non-compliance to requests (Arbelle et al., 1994; Bryce & Jahromi, 2013; Ekas et al., 2017; Lemanek et al., 1993). This higher incidence of passive non-compliance appears to be unique to children with ASD, since this finding has been replicated with children with a range of cognitive and developmental abilities (Sigman et al., 1985; Bryce & Jahromi, 2013), and that children's receptive language abilities alone did not account for the higher incidence of passive non-compliance among preschoolers with HFA (Bryce & Jahromi, 2013). In combination with prior studies, the findings of the current study support that children's receptive language abilities account for some, but not at all, of the variability in children's use of passive non-compliance, with lower receptive language abilities predicting more passive non-compliance. It is speculated that

social-communication deficits, including difficulties with interpreting subtle social cues or nonverbal gestures, may account for some of the remaining variance in children's passive non-compliance (Bryce & Jahromi, 2013). Other theories attribute this difficulty with interpreting indirect requests to deficits in theory of mind (Baren-Cohen, 2000), which could make it challenging to infer the underlying intention of indirect requests (Papp, 2006).

Children's proportion of compliance with caregivers' requests at baseline varied depending on the type of request used by caregivers, with children exhibiting a higher proportion of compliance to direct requests than to indirect requests. Although children's proportion of compliance to direct and indirect requests was not associated with receptive language at baseline, the proportion of overall requests (both direct and indirect) that children complied with was related to children's receptive language age equivalent, supporting the speculated association between children's ability to comply with requests and with their receptive language abilities.

The Effect of Treatment on Children's Compliance to Caregiver's Requests Over Time

For children in the JASPER condition, increases in children's proportion of compliance to direct requests at exit and the 3-month follow-up was detected from entry to exit and entry to the 3-month follow-up, but the same was not found for children whose caregivers were assigned to receive PEI. Since JASPER has been found to improve children's use of language (Gulsrud et al., 2016), it is possible that children's improvement in their compliance with direct requests may be associated with gains in receptive language. Another possible explanation for this phenomenon is that caregivers may be using more developmentally appropriate language and behavioral strategies, such as following through, in order to facilitate children's understanding of and responding to direct requests, although no treatment effect was found for caregivers' use of requests over time. Due to the nature of these analyses, it is not possible to definitively determine

the underlying mechanism that led to the change in children's compliance with caregivers' direct requests, nor how caregivers' behaviors contributed to children's compliance to direct requests. No change in children's proportion of compliance with indirect requests and total requests was detected for children in either group. This finding further underscores the possibility that indirect requests are inherently more challenging to understand for children with ASD (Bryce & Jahromi, 2013; Papp, 2006). Altogether, these results contribute to the literature on the effect of caregiver-mediated intervention on compliance to caregiver requests in young children with ASD and merit further exploration.

Limitations, Implications and Future Directions

There are several limitations of this study that must be acknowledged, the most prevalent being that the analyses in this study do not account for the dyadic interaction between caregivers and children, rather examine caregiver and child behaviors independently of one another. The findings add to the understanding of how caregiver and child behaviors are associated with one another but cannot attribute causality or speak to directionality. Additionally, this study would have benefitted from the inclusion of a matched sample of children who did not receive intervention during the course of the study, in order to determine the contribution of *any* treatment to children's compliance over time. Lastly, this study is limited by its sample size, which limited the scope of the analysis. This is in part due to the fact that 11 participants were removed from the sample as a result of protocol deviations and missing video data.

Despite these limitations, the findings of this study contribute to the literature describing caregivers' use of requests and children's compliance behavior in young children with ASD, an area that has been largely unexplored. In examining the impact of treatment on caregivers' use of requests over time, no significant effect of treatment was detected for caregivers' proportion of

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direct requests or indirect requests in either group. A significant treatment effect was found, on the other hand, for children's compliance with direct request strategies over time, suggesting that caregiver-mediated social-communication interventions, such as JASPER, may be effective in improving children's compliance with caregivers' direct requests. This finding did not extend to children's compliance with caregivers' indirect requests and total requests, which could suggest a possible inherent difference in how children with ASD receive direct and indirect requests.

These findings indicate the need for further exploration of the facets of compliance to caregiver requests in young children with ASD. First, further research is needed to better understand caregivers' use of requests with young children with ASD, as well as how children comply differentially with requests over time. Next, findings of this study support a need to investigate if and how caregiver-mediated interventions impacts children's direct and indirect compliance over time. Lastly, a dyadic approach to investigating the relationship between caregivers' requests and children's compliance over time is needed to better understand the directional and causal relationships between these behaviors.

Appendix A - Tables

Table 1

	PEI		JASPER		Total	
	<i>N (75)</i>	<i>% of Total</i>	<i>N (75)</i>	<i>% of Total</i>	<i>N (75)</i>	<i>% of Total</i>
Ethnicity						
<i>African American</i>	2	2.7	0	0	2	2.7
<i>Caucasian</i>	21	28	24	32	45	60
<i>Hispanic</i>	3	4	3	4.0	6	8
<i>Asian</i>	5	6.7	4	5.3	9	12
<i>Other</i>	5	6.7	8	10.7	13	17.3
Gender						
<i>Male</i>	29	38.70	33	44	62	82.7
<i>Female</i>	7	9.30	6	8	13	17.3
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
Chronological Age	32.39	2.61	30.64	3.558	31.48	3.24
(months)						
Receptive	18.27	11.06	17.44	10.135	14.00	10.53
Language (months)						
ADOS Severity	6.03	1.81	5.95	2.336	6.00	2.09
<i>Child Demographics by Treatment Group at Baseline</i>						

Receptive language age equivalent scores are from the Mullen Scales of Early Learning.
ADOS severity is a standardized severity score from the Autism Diagnostic Observation Schedule

Table 2

Parent Demographics by Treatment Group at Baseline

	PEI		JASPER		Total	
	<i>N (75)</i>	<i>% of Total</i>	<i>N (75)</i>	<i>% of Total</i>	<i>N (75)</i>	<i>% of Total</i>
Education						
<i>High School Graduate</i>	2	2.7	0	0	2	2.7
<i>Some College</i>	6	8	6	8.0	12	16
<i>Special Training</i>	2	2.7	0	0	2	2.7
<i>College Graduate</i>	16	21.3	19	25.3	35	46.7
<i>Graduate School</i>	10	13.3	14	18.7	24	32
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
Chronological Age	34.69	4.54	36.49	4.27	35.64	4.46
(years)						

Table 3

Independent Samples T-tests Comparing Groups on Baseline Caregiver & Child Characteristics

	PEI		JASPER		<i>t</i>	Sig.
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>		
Child Age (months)	32.39	2.61	30.64	3.56	2.409	.044
MSEL Receptive Language	18.27	11.06	17.44	10.14	0.343	.511
ADOS Severity	6.03	1.81	5.95	2.34	0.165	.316
Total Time (seconds)	101.39	55.45	98.42	46.88	0.249	.804
Caregiver Age	34.69	4.54	36.49	4.27	-1.80	.083

Time and Parental Requests

Table 4

 χ^2 Tests Comparing Groups on Baseline Caregiver & Child Characteristics

	PEI (n)	JASPER (n)	χ^2	df	Sig.
Ethnicity			2.888	4	.577
<i>African American</i>	2	0			
<i>Caucasian</i>	21	24			
<i>Hispanic</i>	3	3			
<i>Asian</i>	5	4			
<i>Other</i>	5	8			
Caregiver Education			4.812	4	.307
<i>High school</i>	2	0			
<i>Some College</i>	6	6			
<i>Vocational School</i>	2	0			
<i>College Graduate</i>	16	19			
<i>Graduate degree</i>	10	14			

Time and Parental Requests

Table 5

Frequency of Children's Compliance Behaviors and Caregiver Requests at Baseline

	<i>Mean</i>	<i>SD</i>
Children Variables		
Compliance	3.57	3.36
Passive Non-Compliance	3.80	3.97
Caregiver Variables		
Direct Requests	2.89	3.12
Indirect Requests	6.01	3.22
Total Requests	8.67	4.71

Time and Parental Requests

Table 6

Proportions of Caregivers' Requests and Children's Compliance at Baseline

	<i>Mean</i>	<i>SD</i>
Compliance Proportions		
Direct Requests	0.48	0.42
Indirect Requests	0.39	0.35
Overall Compliance	0.45	0.33
Request Proportions		
Direct Requests	0.29	0.26
Indirect Requests	0.70	0.27

Table 7

Independent Samples T-tests Comparing Groups on Frequency of Child Compliance Behaviors and Caregiver Requesting Behavior at Entry

	PEI		JASPER			
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>t</i>	Sig.
Compliance	3.61	3.52	3.53	3.26	0.108	.707
Passive	4.31	4.63	3.32	3.23	1.07	.015
Non-Compliance						
Direct Requests	2.89	3.276	2.89	3.01	-0.01	.959
Indirect Requests	5.94	3.50	6.08	2.99	-0.18	.368
Total Requests	8.59	4.95	8.74	4.54	-0.14	.227

Time and Parental Requests

Table 8

Independent Samples T-tests Comparing Groups on Proportions of Caregivers' Requests and Children's Compliance at Baseline

	PEI		JASPER			
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>t</i>	Sig.
Compliance Proportions						
Direct Compliance	0.61	0.40	0.34	0.40	2.44	.016
Indirect Compliance	0.39	0.38	0.39	0.32	0.04	.966
Overall Compliance	0.45	0.34	0.44	0.32	0.86	.932
Request Proportions						
Direct Requests	0.31	0.27	0.27	0.24	0.60	.548
Indirect Requests	0.69	0.29	0.71	0.26	-0.36	.721

Time and Parental Requests

Table 9

Partial Correlation between Frequency of Caregiver Requests and Frequency of Children's Compliance Behaviors at Baseline

Measure	1	2	3	4
1. Direct Requests	1	-.013	.364**	.336**
2. Indirect Requests		1	.203	.348**
3. Compliance			1	-.128
4. Passive Non-Compliance				1

Note. *** $p < .001$, ** $p < .01$, * $p < .05$; values presented control for children's ADOS severity score, MSEL receptive language age equivalent and chronological age.

Time and Parental Requests

Table 10

*Bivariate Correlation between Children's Compliance Proportions and Children's**Characteristics at Baseline*

Measure	1	2	3	4	5	6
1. Direct Compliance	1	.471**	.623**	.124	-.051	.251
2. Indirect Compliance		1	.868**	.227	.084	.113
3. Overall Compliance			1	.318**	.104	.001
4. MSEL RL				1	.143	.188
5. ADOS Severity					1	.083
6. Chronological Age (months)						1

Note. *** $p < .001$, ** $p < .01$, * $p < .05$;

Time and Parental Requests

Table 11

*Bivariate Correlation between Caregiver Request Proportions and Children's Characteristics at**Baseline*

Measure	1	2	3	4	5
1. Direct Requests	1	-.961**	-.043	.143	-.066
2. Indirect Requests		1	.099	.265*	.067
3. Receptive Language			1	.143	.083
4. ADOS Severity				1	.486
5. Chronological Age					1

Note. *** $p < .001$, ** $p < .01$, * $p < .05$

Time and Parental Requests

Table 12

Child Compliance Behaviors by Treatment Group Over Time

	Entry				Exit				Follow-up			
	PEI		JASPER		PEI		JASPER		PEI		JASPER	
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
Frequencies												
Compliance	3.61	3.52	3.53	3.26	3.24	2.40	5.82	3.70	4.34	3.79	4.76	3.72
Passive	4.31	4.63	3.32	3.23	3.41	4.17	3.47	3.06	1.34	1.93	3.18	3.44
Non-Compliance												
Proportions												
Direct Compliance	0.61	0.40	0.34	0.40	0.68	0.32	0.56	0.34	0.70	0.41	0.69	0.31
Indirect Compliance	0.39	0.38	0.39	0.32	0.44	0.34	0.49	0.30	0.59	0.35	0.47	0.33
Overall Compliance	0.45	0.34	0.44	0.32	0.54	0.31	0.56	0.25	0.70	0.35	0.60	0.29

Time and Parental Requests

Table 13

Caregiver's Use of Request by Treatment Group Over Time

	Entry				Exit				Follow-up			
	PEI		JASPER		PEI		JASPER		PEI		JASPER	
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
Frequencies												
Direct	2.89	3.28	2.89	3.01	3.00	3.78	3.87	3.54	1.84	2.81	3.82	3.97
Requests												
Indirect	5.94	3.50	6.08	2.99	4.09	2.89	6.00	3.90	4.09	2.90	4.85	3.56
Requests												
Total	8.59	4.95	8.74	4.54	7.09	5.23	9.87	4.36	5.94	4.37	8.68	4.79
Requests												
Proportions												
Direct	0.31	0.29	0.27	0.24	0.33	0.28	0.42	0.28	0.23	0.26	0.41	0.32
Requests												
Indirect	0.69	0.29	0.71	0.26	0.67	0.28	0.58	0.28	0.76	0.27	0.59	0.32
Requests												

Time and Parental Requests

Table 14

Fixed Effects: GLMM Predicting the Effect of Treatment on Caregivers' Proportion of Direct Requests Over Time

	dfNumerator	DfDenominator	F	Sig.
Intercept	9	187	2.39	.014
Timepoint	2	187	1.84	.162
Tx Group	1	187	3.76	.054
Child Age	1	187	1.86	.175
Receptive Language	1	187	6.46	.012
ADOS Severity	1	187	.200	.655
Total Time (seconds)	1	187	2.62	.107
Timepoint * Tx Group	2	187	1.48	.232

Time and Parental Requests

Table 15

Parameter Estimates: GLMM Predicting the Effect of Treatment on Caregivers' Proportion of Direct Requests Over Time

Parameter	Estimate	SE	t	Sig	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	0.14	0.30	0.47	.637	-0.45	0.73
Timepoint						
Entry	-.141	0.07	-2.08	.039	-0.28	-0.07
Exit	-.007	0.07	-0.10	.917	-0.14	-0.13
FU	0 _a	-	-			
Tx						
Education	-.168	0.07	-2.27	.024	-0.31	-0.02
JASPER	0 _a	-	-	-	-	-
Child Age	.009	0.01	1.36	.175	0	0.02
Receptive Language	-.005	0	-2.54	.012	-0.10	0
ADOS Severity	.005	0.01	0.45	.655	-0.02	0.03
Total Time (seconds)	.001	0	1.62	.088	0	0
Timepoint*Tx						
Entry *	0.17	0.10	1.72	.033	0.25	0.37
Education						
Entry *	0 _a	-	-	-	-	-
JASPER						
Exit *	0.09	0.10	0.86	.392	-0.11	0.28
Education						
Exit *	0 _a	-	-	-	-	-
JASPER						
FU *	0 _a	-	-	-	-	-
Education						
FU *	0 _a	-	-	-	-	-
JASPER						

Note: a Parameter is set to zero because it is redundant

Time and Parental Requests

Table 16

Fixed Effects: GLMM Predicting the Effect of Treatment on Caregivers' Proportion of Indirect Requests Over Time

	dfNumerator	DfDenominator	F	Sig.
Intercept	9	188	2.341	.013
Timepoint	2	188	1.45	.237
Tx Group	1	188	3.78	.053
Child Age	1	188	1.67	.198
Receptive Language	1	188	8.24	.005
ADOS Severity	1	188	0.43	.511
Total Time (seconds)	1	188	2.38	.124
Timepoint * Tx Group	2	188	1.03	.359

Time and Parental Requests

Table 17

Parameter Estimates: GLMM Predicting the Effect of Treatment on Caregivers' Proportion of Direct Requests Over Time

Parameter	Estimate	SE	t	Sig	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	0.85	0.30	2.79	.006	0.25	1.45
Timepoint						
Entry	0.12	0.07	1.82	.071	-0.01	0.258
Exit	0.01	0.07	0.11	.914	-0.13	-0.14
FU	0 _a	-	-			
Tx						
Education	0.16	0.07	2.09	.038	0.01	0.30
JASPER	0 _a	-	-	-	-	-
Child Age	-0.01	0.01	-1.30	.198	-0.02	0
Receptive Language	0.01	0	2.87	.005	0	0.1-
ADOS Severity	-0.01	0.01	-0.66	.511	-0.03	0.02
Total Time (seconds)	0	0	-1.54	.124	0	0
Timepoint*Tx						
Entry *	0.14	0.10	-1.44	.152	-0.34	0.05
Education						
Entry *	0 _a	-	-	-	-	-
JASPER						
Exit *	-0.08	0.10	-0.74	.460	-0.27	0.13
Education						
Exit *	0 _a	-	-	-	-	-
JASPER						
FU *	0 _a	-	-	-	-	-
Education						
FU *	0 _a	-	-	-	-	-
JASPER						

Note: a Parameter is set to zero because it is redundant

Time and Parental Requests

Table 18

Fixed Effects: GLMM Predicting the Effect of Treatment on Children's Proportion of Compliance to Direct Requests over Time

	dfNumerator	DfDenominator	F	Sig.
Intercept	10	112	5.87	.000
Timepoint	2	112	3.30	.040
Tx Group	1	112	0.34	.561
Child Age	1	112	3.43	.067
Receptive Language	1	112	1.05	.308
ADOS_Severity	1	112	0	.960
Total Time	1	112	4.709	.032
Baseline Direct Compliance	1	112	20.61	.000
Timepoint*Tx Group	2	112	3.20	.045

Time and Parental Requests

Table 19

Parameter Estimates: GLMM Predicting the Effect of Treatment on Children's Proportion of Compliance to Direct Requests over Time

Parameter	Estimate	SE	t	Sig	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	0.10	0.42	2.23	.817	-0.74	0.93
Timepoint						
Entry	-0.36	0.10	-3.75	.000	-0.55	-0.17
Exit	-0.12	0.10	-1.22	.224	-0.31	0.07
FU	0 _a	-	-			
Tx						
Education	-0.19	0.12	-1.57	.120	-0.42	0.05
JASPER	0 _a	-	-	-	-	-
Child Age	0.02	0.01	1.85	.067	0	0.04
Receptive Language	0	0	1.02	.308	0	0
ADOS Severity	0	0.02	-0.05	.960	-0.03	0.03
Total Time (seconds)	0	0	-2.17	.032	0	0
Baseline Direct Compliance	0.36	0.08	4.54	.000	0.20	0.52
Timepoint*Tx						
Entry *	0.35	0.15	2.34	.021	0.05	0.64
Education						
Entry *	0 _a	-	-	-	-	-
JASPER						
Exit *	0.10	0.16	0.61	.546	-0.21	0.40
Education						
Exit *	0 _a	-	-	-	-	-
JASPER						
FU *	0 _a	-	-	-	-	-
Education						
FU *	0 _a	-	-	-	-	-
JASPER						

Note: a Parameter is set to zero because it is redundant

Time and Parental Requests

Table 20

*GLMM Predicting the Effect of Treatment on Caregivers' Requests Over Time – Pairwise**Comparisons of Children's Proportion of Compliance to Direct Requests*

PEI	<i>Entry vs. Exit</i>	0.02	0.10	0.14	112	.886	-0.19	0.22
	<i>Entry vs. FU</i>	-0.01	0.11	-0.08	112	.940	-0.12	0.22
JASPER	<i>Entry vs. Exit</i>	-0.24	0.09	-2.67	112	.009	-0.42	-.06
	<i>Entry vs. FU</i>	-0.36	1.00	-3.75	112	.000	-0.55	-0.17

Time and Parental Requests

Table 21

Fixed Effects: GLMM Predicting the Effect of Treatment on Children's Proportion of Compliance to Indirect Requests over Time

	dfNumerator	DfDenominator	F	Sig.
Intercept	9	184	2.678	.006
Timepoint	2	184	2.387	.095
Tx Group	1	184	0.073	.787
Child Age	1	184	1.148	.285
Receptive Language	1	184	7.085	.008
ADOS_Severity	1	184	1.887	.171
Total Time	1	184	6.400	.012
Timepoint*Tx Group	2	184	0.819	.443

Time and Parental Requests

Table 22

Parameter Estimates: GLMM Predicting the Effect of Treatment on Children's Proportion of Compliance to Indirect Requests over Time

Parameter	Estimate	SE	t	Sig	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	0.01	0.36	0.28	.783	-0.61	0.81
Timepoint						
Entry	-0.09	0.08	-1.12	.264	-0.26	0.07
Exit	0.05	0.08	0.57	.573	-0.12	0.21
FU	0 _a	-	-			
Tx						
Education	0.06	0.09	0.63	.531	-0.12	0.24
JASPER	0 _a	-	-	-	-	-
Child Age	0.01	0	1.07	.285	-0.01	0.02
Receptive Language	0.01	0	2.66	.008	0	0.01
ADOS Severity	0.02	0.01	1.37	.171	-0.01	0.05
Total Time (seconds)	0	0	-2.53	.012	0	0
Timepoint*Tx						
Entry *	-0.06	0.12	-0.50	.616	-0.30	0.18
Education						
Entry *	0 _a	-	-	-	-	-
JASPER						
Exit *	-0.15	0.12	-1.26	.208	-0.39	0.09
Education						
Exit *	0 _a	-	-	-	-	-
JASPER						
FU *	0 _a	-	-	-	-	-
Education						
FU *	0 _a	-	-	-	-	-
JASPER						

Note: _a Parameter is set to zero because it is redundant

Time and Parental Requests

Table 23

Fixed Effects: GLMM Predicting the Effect of Treatment on Children's Proportion of Overall Compliance to Caregivers' Requests over Time

	dfNumerator	DfDenominator	F	Sig.
Intercept	9	185	4.27	.000
Timepoint	2	185	6.47	.002
Tx Group	1	185	0.04	.852
Child Age	1	185	0.07	.794
Receptive Language	1	185	14.61	.000
ADOS_Severity	1	185	0.44	.510
Total Time	1	185	6.78	.010
Timepoint*Tx Group	2	185	0.49	.615

Time and Parental Requests

Table 24

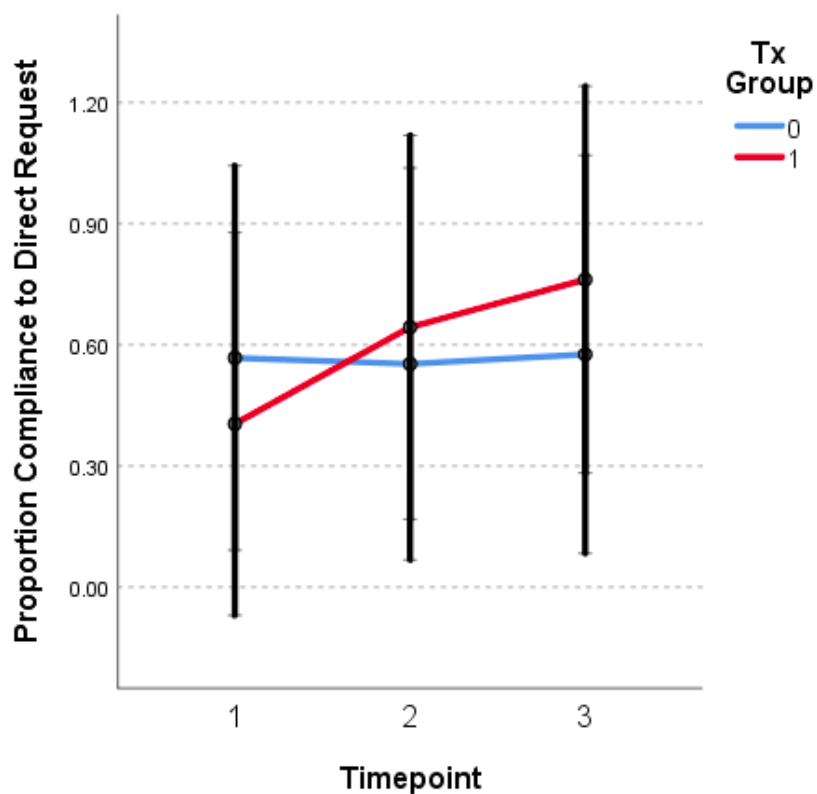
Parameter Estimates: GLMM Predicting the Effect of Treatment on Children's Proportion of Overall Compliance to Caregivers' Requests over Time

Parameter	Estimate	SE	t	Sig	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	0.46	0.31	1.46	.147	-0.16	1.08
Timepoint						
Entry	-0.17	0.07	-2.36	.019	-0.31	-0.03
Exit	-0.02	0.07	-0.32	.751	-0.17	0.12
FU	0 _a	-	-			
Tx						
Education	-0.05	0.08	0.68	.497	-0.10	0.21
JASPER	0 _a	-	-	-	-	-
Child Age	0	0.01	0.26	.794	-0.01	0.02
Receptive Language	0.01	0	3.82	.000	0	0.01
ADOS Severity	0.01	0.01	0.66	.510	-0.01	0.03
Total Time (seconds)	0	0	-2.60	.010	0	0
Timepoint*Tx						
Entry *	-0.03	0.10	-0.33	.744	-0.24	0.17
Education						
Entry *	0 _a	-	-	-	-	-
JASPER						
Exit *	-0.10	0.11	-0.96	.337	-0.31	0.11
Education						
Exit *	0 _a	-	-	-	-	-
JASPER						
FU *	0 _a	-	-	-	-	-
Education						
FU *	0 _a	-	-	-	-	-
JASPER						

Note: a Parameter is set to zero because it is redundant

Appendix B – Figures

Figure 1: Effect of treatment on children's proportion of compliance to direct strategies over time



Note: Continuous predictors are fixed at the following values: Child age = 31.22, MSEL RL= 17.43, ADOS Severity = 6.35, Total Time = 105.28, Entry Direct Compliance = 0.47; Tx Group 0 = PEI, Tx Group 1 = JASPER.

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