Dosage, Fidelity, and Child Outcomes in a Small Randomized Controlled Trial of EMT en Español

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CHAPTER 1

Introduction

1.1 Background

Developmental language disorders in early childhood may have a negative impact on children's social, behavioral, communication, and psychological trajectories (Carpenter & Drabick, 2011; Conti-Ramsden et al., 2019; Langbecker et al., 2020; Le et al., 2020; Tomblin et al., 2000). Thus, early intervention to support language development during the preschool years may be critical to change these trajectories. For children under the age of four, early language intervention is most often implemented by the primary caregiver (Law et al., 2017; Roberts & Kaiser, 2011). Although there is strong evidence that caregiver mediated interventions can be effective (Heidlage et al., 2021) and that significant effects are sustained over time (Pak, et al., 2023), few group design intervention studies have included Spanish-speaking children with language delays and their caregivers. These children are often under-identified in practice and underrepresented in research due to a lack of Spanish-speaking providers and researchers and other resources to support multilingual development.

Most caregiver-implemented early language interventions are consistent with a Naturalistic Developmental Behavioral Intervention (NDBI) framework (see Schreibman et al., 2015). Caregivers are taught strategies that combine behavioral strategies and naturalistic teaching approaches in a developmentally appropriate framework to be implemented in natural environments with their children. NDBIs are evidence-based strategies that have been shown to support behavioral, communication, and language outcomes in young children. Shared components across naturalistic interventions include environmental arrangement, naturalistic

reinforcement to sustain child engagement, adult modeling, prompting, and imitation to teach targeted skills. NDBIs that include caregiver implementation are perhaps the most beneficial in early childhood because caregivers often can provide intervention across naturalistic settings, including daily living activities and play at home (Roberts & Kaiser, 2011). Caregiver-implemented NDBIs include: Joint Attention Symbolic Play Engagement and Regulation (JASPER; Kaale et al. 2012, 2014; Kasari et al. 2006, 2008, 2010, 2014), reciprocal imitation training (RIT; Ingersoll 2010; Ingersoll and Schreibman 2006), the Early Start Denver Model (ESDM; Dawson et al. 2010; Rogers & Dawson 2010; Rogers et al. 2012), Pivotal Response Training (PRT; Koegel & Koegel, 2006), and Enhanced Milieu Teaching (EMT; Kaiser & Hampton, 2017).

NDBIs were initially described as interventions for children with autism (Schreibman et al., 2015). However, these interventions are also effective for children who have challenging behavior, language delays, or other developmental disorders (Kaiser & Roberts, 2013; Scherer et al., 2020; Wright et al., 2016). NDBIs continue to be adapted for a range of populations of children and their caregivers.

1.2 Adapting NDBIs for Spanish-speaking Populations

One group that is rapidly growing in the U.S. is dual language learners (DLL), specifically DLLs who come from Spanish-speaking households. Although the exact number of children from this group who will have autism, challenging behavior, and/or language delays is unknown, the incidence of these communication related disabilities and delays is assumed to be like that of the general population (6-15%; Law et al., 2000). As the number of children who are Spanish-speaking and who evidence early communication delays increases with improved access to early diagnosis and services, it is important to adapt evidence-based interventions to be

culturally and linguistically appropriate. At this time, there are very few NDBIs that have been translated, adapted, implemented, and socially validated for this population of caregivers and children (Luna, 2023; Magana, 2023, Peredo et al., 2018; Peredo et al., 2022).

1.3 Interaction Styles in Spanish-speaking Families

For Spanish-speaking families living in the U.S., the home culture often merges with that of the mainstream culture. In many Spanish-speaking Latino families, ideas such as *familismo, respeto,* and *machismo* permeate through values and daily life. *Familismo* is consistent with a collectivist culture and is the belief that there is an obligation to form strong bonds and loyalty to one's family (Barker et al., 2010; Calzada & Eyeberg, 2002). *Respeto* is the idea that children should be respectful and obedient to their elders, and *machismo* is the belief of traditional gender roles in which the male acts as the leader of the home and the female is expected to take care of the household and caregiving responsibilities (Barker et al., 2010).

Immigration status also impacts a family's values and the way they interact with one another. For those who are undocumented living in the U.S., mothers report a high importance of teaching their children values including altruism, hard work, caution, resourcefulness, and contributing positively to the U.S. Additionally, these mothers often identify themselves as disciplinarians and perfectionists who protect their children by remaining affectionate and sometimes coddling (Rendón, 2022). The length of time in the U.S. is also related to acculturation and the preservation of traditional beliefs.

Largely due to *machismo,* most of the research on interaction styles comes from work with mother-child dyads. Aligning with cultural beliefs, Latina mothers tend to be directive, protective, highly responsive, and affectionate (Cycyk & Hammer, 2020; Dyer et al., 2014; Peredo et al., 2020). Although the culture of Spanish-speakers in the U.S. varies greatly, cultural

differences from the mainstream culture are important to note when making clinical and intervention decisions for an individual family.

1.4 EMT and EMT en Español

At this time, one of the only NDBIs that has been adapted specifically for Spanish-speakers in the U.S. is EMT en Español (Peredo et al., 2018; Peredo et al., 2022). EMT has been taught to English-speaking caregivers of young children with a wide range of language and social communication abilities, including children with ASD, Down syndrome, and developmental language disorders (Kaiser & Hampton, 2017). This intervention uses a core set of strategies including matched turns, target language, expansions, time delays, and prompting, or milieu episodes, to support children's language and communication development. Although the setting can vary, intervention is commonly conducted in the family's home and implemented by the child's primary caregiver, who is supported by an expert therapist.

Recently, EMT has been adapted and implemented with Spanish-speaking caregivers of children with language delays living in the U.S. (Peredo et al., 2018; Peredo et al., 2022). Caregivers demonstrated increased use of EMT en Español strategies when systematically taught to implement these skills at home during play, book reading and daily routines. Furthermore, children whose caregivers received training in the EMT en Español intervention performed better on measures of child language outcomes than those whose caregivers did not receive intervention (Peredo et al., 2022). Social validity measures and interviews with families indicated that the strategies were culturally appropriate and naturalistic for this population.

Cultural and linguistic differences were accounted for in material and strategy adaptations throughout the intervention. All materials were translated and adapted from English to Spanish with input from Spanish-speaking providers and caregivers. Specific EMT strategies

such as targets and matched turns were also considerably adapted based on typical caregiver-child interaction styles within this population. Due to differences in the country of origin, dialects of Spanish are highly variable, and this was especially important when teaching target language to the caregiver to use with their child. Caregivers were asked about dialectical differences in every session and were encouraged to use the most naturalist linguistic input at target level for their child. Feedback from caregivers resulted in a "Rule of Thirds" for linguistic input. Therapists and caregivers used targets for one-third of the time and proximal targets for one-third of the time, leaving about one-third of the time for linguistic others (e.g., "me gusta," "dame," "ven").

Similarly, cultural differences in Spanish-speaking Latino families, such as caregivers' high directiveness and responsiveness, expanded the criteria for matched turns. Previously, a turn was considered matched only if it was contingent and related to the child's utterance. However, Spanish-speaking caregivers often use directives such as "mira" ("look") to get the child's attention. In the adapted version of EMT en Español, "related turns" allow caregivers to use these directives alongside a contingent utterance and still be considered a matched turn.

1.5 Intervention Dosage

After a language intervention has sufficient research evidence to indicate effectiveness, it is important to understand the amount and intensity of that intervention that is necessary to result in changes in children's language and communication skills. Insufficient dosage of an intervention may produce few results in terms of child outcomes and too much may result in unnecessary costs for the provider and families (Sciberras et al., 2014). Generally, dosage in NDBIs has been measured as the amount of intervention delivered in units of intervention (e.g., total number of sessions, minutes or hours of intervention including training for caregivers and

caregiver delivery of the intervention) (Warren et al., 2007). However, this simple view of dosage does not account for provision of the active ingredients of intervention that are most likely to impact child outcomes. Warren et al., (2007) suggest that the idea of "treatment intensity" is an inadequate way to describe dosage because it only accounts for duration and not the frequency of the active ingredients of communication interventions.

To estimate the dosage of the intervention, we must first know what specific intervention component is driving changes in child outcomes from the intervention. This more complex view of treatment intensity is made up of dose ("number of properly administered teaching episodes during a single intervention session" Warren et al., 2007, p. 71), dose frequency ("the number of times a dose of intervention is provided per day and per week" Warren et al., 2007, p. 72), and total intervention duration ("the time period over which a specified intervention is presented" Warren et al., 2007, p. 72) in the following formula: *Cumulative intervention intensity = dose* x *dose frequency* x *total intervention duration.*

Zeng et al. (2012) conducted a systematic review using the categories proposed by Warren et al. (2007) to explore "optimal" dosage in interventions for young children with speech and language delays. Their results indicated that research studies rarely reported enough information to determine a teaching episode or calculate the cumulative intervention intensity. The authors of this review also argued that without exploring the relation between dosage and effect size, there is no way to determine the optimal amount of intervention and that more intervention is not the answer. In a review specific to milieu teaching interventions, Parker-McGowan et al. (2014) also noted a lack of reporting the dosage parameters from Warren et al. (2007), specifically in group design studies. Findings from this review indicate that there is a

need for a clear definition of treatment intensity and dosage parameters to link dosage to treatment outcomes.

In an updated review examining dosage and phonology, vocabulary, and morphosyntax outcomes of intervention studies for children with developmental language disorder (DLD), Frizelle et al. (2021) also found a lack of reporting the Warren et al. (2007) categories, and when reported, the dosage characteristics were rarely controlled in intervention delivery. Although Frizelle et al. (2021) were unable to determine the optimal dosage for these interventions from their review, the findings provide a foundation for the frequency of sessions (high dose, low frequency) and suggest that there is a point in intervention where progress plateaus and thus there is no need to continue.

Justice et al. (2017) took a different approach to addressing the potential overtreatment/undertreatment conflict by analyzing child outcomes from language intervention and deriving algorithms to determine intervention intensity. The algorithm formula consisted of the following variables: desired points of change, child's baseline language skills, average number of minutes spent targeting language in a session, total number of sessions conducted across the year, and cumulative intensity. While this takes the "guess work" out of intervention decisions by removing the need for clinical judgment, the data used to derive these algorithms were from correlational intervention data in public schools implemented by speech language pathologists and may not apply to caregiver-implemented interventions. Thus, more research is needed to demonstrate a potential causal link between intervention intensity and child outcomes and to increase the population parameters for greater generalizability (Justice et al., 2017).

1.6 Active Ingredients of Intervention

In addition to researchers underreporting the delivery of an exact or optimal dosage of an intervention, there is also limited consideration of the components of intervention that are the active ingredients presumed to be the driving force behind change in child communication behavior. Warren et al. (2007) suggested that examining dosage using their approach would help researchers determine the active ingredients, or specific teaching episodes that drive child change within an intervention. Unpacking the core components of an intervention in this would allow for testing the association between dosage and outcomes.

A small number of studies have sought to determine the active ingredients of NDBIs (Frost et al., 2021; Gulsrud et al., 2016; Mejia et al., 2016; Pickles et al., 2015). For example, Gulsrud et al. (2016) used hierarchical linear regression to determine that the strategy, mirrored pacing, was responsible for change in child behavior in a parent-implemented social communication intervention. Roberts and Kaiser (2015) and Hampton et al. (2020) noted that semantically related target language and target level linguistic input within an adult-child matched turn were the strategies that drove child outcomes in studies of caregiver-implemented EMT.

Thus, the active ingredients are not solely dependent on the amount of intervention delivered by the adult and how the adult implements the intervention; it is also necessary to understand how the child's behavior determines how much of an intervention can be delivered. To deliver an optimal dosage of a naturalistic intervention, the adult must have sufficient opportunities presented by the child. This reciprocal relationship between adult behavior (responding or expansions contingent on child communication, for example) is dependent on the child's production of social communicative utterances and expandable verbal utterances

(Girolametto et al., 1999; Tamis-LeMonda, et al., 2001; Yoder et al., 2001). This type of conversation is believed to support language development through a series of exposure, practice, and feedback between the adult and child (Warlaumont et al., 2014). Other child behavioral variables that are often unmeasured also impact a child's ability to be an active partner. These variables include child responses to adult utterances, child engagement, the level and quality of play, child behaviors that disrupt interactions, and the clarity and quality of child language.

1.7 Fidelity

Similar to the Zeng et al.'s (2012) argument that reporting dosage parameters without effect sizes limits the positive evidence for use of the intervention, Parker-McGowan et al. (2014) suggested that dosage without a measure of treatment fidelity limits the assumptions that can be made about the overall effectiveness of the intervention. Both measurement of the proposed active ingredients and implementation of essential contextual conditions (e.g., environmental arrangements, choice of play materials) may be important, but this facet of intervention fidelity is grossly understudied and/or underreported potentially because the active ingredient of an intervention is often unknown. After identifying the primary and overlapping components across NDBIs, Frost et al. (2021) created an observational measure to assess fidelity of NDBI's citing the need for a comprehensive, or common, measure instead of lab-specific fidelity checklists. This macro-code was shown to have high reliability with micro-codes and strong validity after intervention (Sone et al., 2021). Although this is a promising measure for advancing measurement across NDBIs with varying components, this general checklist is more difficult to tie to child outcomes than the micro-level checklists that are developed for specific interventions.

1.8 Purpose of the Current Study

At this time, there is little evidence to suggest that the Warren et al. (2007) parameters and formula for dosage are predictive of intervention outcomes. Additionally, it is not yet clear how the dosage of caregivers' use of EMT en Español specific strategies and the fidelity of caregiver implementation of the complete EMT en Español intervention package impact child outcomes. Understanding the linkages between dosage, fidelity, and child outcomes is important to prescribing and adapting caregiver implemented NDBIs to maximize child outcomes in general while using resources efficiently.

In the EMT en Español group design study (Peredo et al., 2022), only procedural and therapist implementation fidelity data were analyzed. The current study examined caregiver implementation of EMT en Español strategies using a checklist that combines qualitative and quantitative data. This checklist includes measures of count and measures of quality of the intervention (e.g., the number of times the caregiver uses target language in matched turn with prosody that is natural sounding, rather than speaking in a manner that is robotic, monotone, or sing-songy voice).

The current study proposes a model of dosage the includes a more precise measure of the proposed primary active ingredient together with an intervention-specific fidelity measure to describe caregiver delivery of EMT en Español. In this model, the target population, Spanish-speaking DLLs with language delays, who participated in a caregiver-implemented intervention, EMT en Español, presumably received variable amounts of the active ingredient and variable levels of fidelity of the intervention. These caregiver EMT en Español behaviors (dosage of the active ingredient and fidelity of delivery), together with key child communication behaviors such as the number of opportunities the child provided for the adult to implement EMT strategies, are

posited to impact proximal (e.g., number of different words, child language use in naturalistic interactions) and distal (e.g., results on standardized assessments) measures of child outcomes.

The purpose of the current study was to examine the dosage of active ingredients and overall fidelity of the caregiver-implemented intervention during a randomized controlled trial of EMT en Español (Peredo et al., 2022). Transcripts from the original data set were recoded to measure dosage and fidelity across caregiver-child dyads. Caregiver dosage and fidelity in the treatment and control groups were examined at pre-test, post-test, and follow-up timepoints. To date, no studies have examined how dosage (as defined by the occurrences of the active ingredient during a session) and fidelity of caregiver-implemented NDBIs are associated with child language outcomes for Spanish-English DLLs.

The current exploratory study will ultimately contribute to understanding what aspects of caregiver-implemented NDBIs are related to child language outcomes. From these findings, we propose an evidence-based framework for caregiver-implemented NDBIs to ensure that these interventions provide sufficient dosage at adequate fidelity to promote optimal child language outcomes.

The guiding research question in this study was "How are caregiver dosage and fidelity related to child language outcomes in a caregiver-implemented NDBI?" This question was addressed in four specific aims:

Aim 1. Examine caregiver dosage of target level language within matched turns, the putative active ingredient of EMT en Español, across (a) all participants and (b) between the intervention and control groups at pre-test, post-test, and follow-up.

Hypothesis 1: Caregiver dosage of the active ingredient will be greater for the intervention group at post-test and follow-up compared to the control group.

Aim 2. Examine caregiver fidelity (e.g., a measure of adherence to the protocol for high quality use of EMT en Español strategies) across (a) all participants and (b) between the intervention and control groups at pre-test, post-test, and follow-up.

Hypothesis 2: Caregiver fidelity of implementation of EMT en Español strategies will be greater for the intervention group at post-test and follow-up compared to the control group.

Aim 3. Examine how caregiver dosage of the active ingredient during post-test and follow-up assessments is related to child language outcomes (expressive and receptive vocabulary) for participants in both the treatment and control group.

Hypothesis 3: Child language outcomes at the post-test and follow-up will be positively associated with the active ingredient dosage measured in the caregiver-child interactions at post-test and follow-up for participants in both treatment and control groups.

Aim 4. Examine the association between caregivers' fidelity of EMT en Español implementation and child language outcomes at post-test and follow-up for participants in both treatment and control groups.

Hypothesis 4: Child outcomes at post-test and follow-up will be positively associated with caregiver fidelity of EMT en Español implementation at post-test and follow-up time points for participants in both treatment and control groups.

CHAPTER 2

Method

2.1 Design

The overall design of the study was descriptive and correlational. Data on caregiver dosage and fidelity of EMT en Español were collected from video recorded sessions of caregiver-child interactions during the pre-test, post-test, and follow-up assessments for both treatment and control groups. In addition, child behavioral data were collected during the caregiver-child assessments for children in both the treatment and control groups at all three timepoints. Standardized child language assessment data were also collected at these timepoints.

Correlational relationships among caregiver language supporting behaviors and child language measures, and between caregiver behavior and child language measures were explored Given the small sample size, limited statistical analysis could be applied to the data; however, descriptive and correlational analyses are potentially useful given the current knowledge of the field and relatively early stage of research on EMT en Español and issues related to dosage.

2.2 Data Set

Data for this study were collected in a small RCT examining the effects of teaching Spanish-speaking caregivers to use EMT en Español with their young children with language delays (Peredo et al., 2022). Participants (Table 1) included 20 Spanish-speaking caregiver-child dyads from low-income households. Children were between 30-43 months old at the beginning of the study and were identified as having a language delay based on language assessments in Spanish and English. Dyads were randomized to an intervention or waitlist control condition.

Participants in both treatment and control conditions completed pre-test, post-test, and 3-month follow-up assessments; these measures are described in the Measures section below.

2.2.1 Intervention Group

Caregivers in the intervention group were systematically taught to implement EMT en Español with their children during play, book reading, and home routines by therapists trained to criterion in EMT en Español and in the systematic caregiver teaching protocol, Teach-Model-Coach-Review (TMCR; Roberts et al, 2014). The therapist, caregiver, and child spoke Spanish throughout the study. Caregiver-child dyads worked with a master's or Ph.D. level therapist for a total of 24 sessions. The intervention was divided into three phases of EMT en Español strategies including: (a) setting the foundation for communication, responsive interactions, child language targets, (b) expansions, and (c) communication elicitation. Each phase began with a one-on-one workshop involving the interventionist and caregiver in which the interventionist provided detailed descriptions of the strategies, video examples, individualized instruction, and an opportunity for the caregiver to practice via role playing prior to implementing the strategies with their child. There were approximately eight sessions per phase.

Sessions were conducted at the dyad's home or another convenient community location (e.g., library, school). The TMCR framework (Roberts et al., 2014) was used to guide each session: (a) the interventionist chose two strategies to focus on for the session and provided a rationale for and examples of using the strategies, (b) the interventionist modeled the strategies by practicing with the child while highlighting strategies to the caregiver, (c) the interventionist coached the caregiver while he/she was practicing with the child. Coaching included providing constructive feedback, praise, and guidance on using the strategies, and (d) the interventionist reviewed what went well in the session and explained how the caregiver could improve for the

following session. Across dyads, intervention sessions lasted approximately 60 minutes each. On average, caregivers in the intervention group completed 23 sessions (range 19 – 24).

2.2.2 Control Group

Participants in the control group did not receive any EMT en Español training during the study but were offered up to 10 sessions with an interventionist after completing all pre-test, post-test, and follow-up assessments. Families in both groups had the option to begin or continue community services for their children throughout the study.

2.2.3 *Measures*

Outcome measures from the original study included: caregiver use of EMT en Español strategies (Table 2), child spontaneous use of different words (NDW; child used a word without a preceding model, question or prompt), and child spontaneous use of total words (NTW) in the caregiver-child interaction, standard scores from the Receptive One Word Picture Vocabulary Test-4 Spanish-Bilingual Edition (ROW-PVT SBE; Martin, 2012) and the Expressive One Word Picture Vocabulary Test-4 Spanish-Bilingual Edition (EOW-PVT SBE; Martin, 2011) (see Table 3 for a summary of these measures). All measures were collected at pre-test, post-test, and at a 3-month follow-up.

Data on caregivers' use of EMT en Español strategies and children's social communication were collected during a 15-min naturalistic play sample with a standardized set of toys and books (CCX; protocol included in Appendix A). The video recorded interactions were transcribed using the Systematic Analysis of Language Transcripts (SALT; Miller & Iglesias, 2020) Spanish software and coded using an observational system designed to measure EMT en Español implementation and child language (see summary in Table 4 and in Appendix B).

In general, caregivers in the intervention condition significantly increased their use of matched turns, target language use, and expansions at post-test, and maintained significantly higher target talk and expansions at follow-up than the control group caregivers. Children in the treatment condition had significantly higher scores only on receptive language at follow-up. For a complete report of the procedures and findings in the RCT, please see Peredo et al, 2022.

2.3 Data Collected for the Current Study

Data for the current study were re-analyzed for fidelity and re-coded to determine the dosage of the active ingredient. In the original study, caregiver use of EMT en Español strategies was analyzed individually (e.g., responsiveness, matched turns, target talk, expansions, prompting episodes). In the current study, the fidelity measure accounted for all these strategies along with caregiver qualities that supported child engagement and behavior. For the current study, the most recent version of the EMT en Español code (Kaiser & Peredo, 2019-2024) was used to obtain more precise measures of matched turns and target talk, the two variables that contribute to the active ingredient.

Measures of children's receptive vocabulary, expressive vocabulary, and syntax were examined in the current study. The receptive vocabulary measure was used in the original study (ROWPVT-4 SBE; Martin, 2012). For expressive language, the number of *rich language targets* were coded from transcripts and summarized across English and Spanish utterances as a measure of conceptual vocabulary. This measure replaced number of different words (NDW) or number of total words (NTW) because it was theoretically supported to be a more sensitive indicator of bilingual children's emergent high-quality vocabulary (Oh & Mancilla-Martinez, 2021). In addition, the number of subject-verb combination was coded in the current study to obtain a measure of early emerging syntax. This measure is based on cross-linguistic data indicating that

the quantity and diversity utterances containing subject-verb combinations index children's progress in developing syntax across most languages (Rispoli et al., 2018). Figure 1 presents a comparison of data in the original study and data in the current study for both caregiver and child variables.

2.3.1 Tiered Linguistic Input

To code the degree to which caregiver input was matched to children's language development, children were first assessed, and their skill level was classified based on a four-level tiered system. The tiered system of linguistic input was developed for, and is being applied in, an ongoing RCT evaluating EMT en Español with caregivers of Spanish-speaking children with language delays (Kaiser, Peredo et al., 2019-2024). Children are assigned to a specific tier that is based on their NDW, MLU, and behavioral characteristics during the baseline assessments. This tier determines the level and guidelines for their caregiver's linguistic input. For example, a child assigned to Tier 1: (a) has less than 50 words across languages, (b) has an MLU of less than 1.5, and (c) stays engaged in a play or book activity for less than 5 minutes. A child in Tier 2: (a) has at least 50 words across languages, (b) has an MLU of 1.5 or greater, (c) has at least four different word combinations, (d) can stay engaged in an activity for more than five minutes without support, and (e) demonstrates at least one example of article use and present progressive verb use (in Spanish). Linguistic input for a Tier 1 child would include a noun in English and Spanish, or a present progressive verb (Spanish only). Linguistic input for a Tier 2 child would include short active declarative sentences such as an article + noun + present or progressive verb (e.g., "The girl is running." or "La niña esta corriendo."). (See Appendix C for a full explanation of tier levels).

In the current study, NDW across languages, MLU, and child behavior were evaluated from the transcripts and video recordings of 15-min CCX at pre-test. The tier levels for the child

and target linguistic input for caregivers were designated and applied in the current analysis. All children were classified as Tier 1 or 2.

2.4 Caregiver Variables

2.4.1 Dosage

Dosage of caregiver linguistic targets (based on tiered system described above and delivered within a matched turn) was coded from the transcripts of the pre-test, post-test, and follow-up CCX samples for all dyads. This measure was the hypothesized active ingredient in EMT en Español. Dosage of this measure was counted as each instance of caregiver use of target language within a matched turn.

Linguistic targets and matched turn definitions were based on the current EMT en Español codebook (Kaiser & Peredo, 2019-2024; see summary in Appendix D). To be considered a linguistic target, the adult had to use (a) target language (words and phrases at the child's developmental level based on the child's tier) or (b) proximal target language (slightly more advanced than their current language level but within the child's zone of proximal development). A matched turn was defined by any of the following codes: (a) matched turn (adult turns that follow a child turn that are contingent and related), (b) related turn (adult turns that follow an adult matched within 3 seconds and are directly related to the previous adult turn in content), and (c) extra turn (unmatched adult turns taken after an interval of 3 seconds in which the child did not take either a play or verbal turn). Table 5 includes examples of linguistic targets within matched turns.

2.4.2 Fidelity of Caregiver Implementation

Caregiver fidelity of EMT en Español strategies at pre-test, post-test, and follow-up was rated by watching the CCX videos and using the revised caregiver fidelity checklist (Appendix

E). The current checklist was more comprehensive than the original fidelity measures which were based on only the percentage of correct use of each EMT en Español strategy. The revised comprehensive fidelity measure included both counts and quality indicators for core EMT strategies, delivery of appropriate linguistic input, environmental arrangement to support play and engagement and behavior support strategies. The comprehensive measure yielded an aggregated score of the caregiver's overall implementation of the intervention (0-100%).

2.5 Child Variables

2.5.1 Receptive Language

The Receptive One Word Picture Vocabulary Test-4 Spanish-Bilingual Edition (ROWPVT-4 SBE; Martin, 2012) is a standardized measure of receptive language across Spanish and English. Raw scores were used from the ROWPVT-4.

2.5.2 Conceptual Vocabulary

Conceptual vocabulary across Spanish and English was determined by analyzing all the child's utterances in the 15-min CCX. Linguistic others (e.g., animal sounds, articles, exclamations) were removed and the number of unique nouns, verbs, and modifiers were counted. Duplicates across languages were removed to calculate the total number of different words across languages.

2.5.3 Unique Subject-Verb Combinations

Child utterances were analyzed from the CCX transcripts. Any subject-verb combination in English or Spanish was compiled into a list. Duplicates were removed and totals were calculated.

2.6 Coding Procedures

2.6.1 Blinding

To keep the principal investigator naïve to the dyad's group status and timepoint, all pre-test, post-test, and follow-up CCX sessions were assigned a random number and coded in order of those numbers. Group and timepoint were not revealed to the principal investigator until all data were coded, summarized, entered, and verified in RedCap prior to the analysis.

2.6.2 Coding

Caregiver-child interactions from video recordings were previously transcribed in SALT Spanish language version by trained undergraduate research assistants who were naïve to the purpose of the study. These students had native or native-like Spanish proficiency and were trained to criterion before transcription for the study began. Additional measures were coded by the principal investigator of the current study using the revised EMT en Español coding manual. The fidelity checklists were completed by the principal investigator after reviewing each video recorded CCX session. Data were entered by the principal investigator and a master's level research assistant, and data entry verification was conducted by the principal investigator. All data were stored in a secure, password protected database (RedCap).

2.6.3 Reliability

To minimize bias, reliability assessments were conducted on 20% of the pre-test, post-test, and follow-up sessions across groups. Reliability coders were blind to the condition of the dyad and the timepoint in which the session occurred. Sessions were randomly selected for reliability coding by the principal investigator using an online randomization application. A master's level student trained on the caregiver fidelity checklist completed coding reliability from the video recorded sessions. A doctoral level student coder trained to reliability on the EMT

en Español coding manual conducted all reliability tasks for dosage including coding the transcripts from the caregiver-child interactions for the active ingredient. Discrepancies between the primary coder and reliability coder were discussed until consensus was reached; consensus codes were used in the data analysis.

2.7 Data Analysis

This exploratory study used descriptive statistics, correlational analyses, t-tests, and linear regressions to (a) describe the dosage of active ingredient and fidelity of implementation of EMT en Español across the entire sample and in the treatment and control groups at pre-test, post-test, and follow-up, (b) compare dosage and fidelity over time (pre-test, post-test, and follow-up) for the entire sample, and within and between treatment and control groups at pre-test, post-test, and follow-up, (c) examine the relations between caregiver dosage of the active ingredient and child language outcomes at post-test and follow-up, and (d) examine the relations between fidelity of EMT en Español and child language outcomes at post-test and follow-up. Data for child outcomes (conceptual vocabulary, subject-verb combinations, ROW-PVT SBE) were also described and compared over time and within groups at pre-test, post-test, and follow-up. A follow-up post-hoc analyses examined the unique contribution of caregiver expansions to child outcomes at follow-up.

To address Aim 1 describing caregiver dosage of active ingredient of EMT en Español across all participants and between the intervention and control groups at pre-test, post-test, and follow-up, the number of times the caregiver delivered the primary active ingredient (target level language within matched turns) was coded from the SALT coded transcripts. Then, the mean and standard deviation were calculated at pre-test, post-test, and follow-up for the entire sample and for the treatment and control groups at each time point separately. A t-test with the pre-test

scores as the outcome was run to test for baseline differences between groups. A correlational analysis was conducted to determine which variables needed to be controlled for in the subsequent analyses and whether post-test and follow-up tests should be run separately. After close examination of the correlation matrix (see Appendix G), it was determined that none of the pre-test variables needed to be controlled for and separate t-tests should be conducted for the entire sample over time and for post-test and follow-up differences between groups.

A similar approach was used to investigate caregiver fidelity (Aim 2). Each pre-test, post-test, and follow-up CCX session was rated using the caregiver fidelity checklist to determine a total fidelity score for that session (range 1-100). Baseline differences between groups were tested using a t-test, and separate t-tests were conducted to assess differences for the entire sample over time and differences between groups at post-test and follow-up.

Aims 3 and 4 analyzed the association between caregivers' dosage of the active ingredient, fidelity of overall EMT en Español implementation, and child language outcomes at post-test and follow-up. To avoid correlated measurement error, dosage and fidelity at post-test were only used to predict receptive vocabulary at post-test and follow-up due to the other caregiver and child variables being collected from the same measurement context (Yoder et al., 2018). First, child outcome data were summarized for the three variables (conceptual vocabulary, subject-verb combinations, and ROW-PVT SBE) for the entire sample over time (pre-test, post-test, and follow-up) and for the treatment and control groups separately. Using coded dosage data and the overall caregiver EMT en Español fidelity scores from each dyad, separate linear regressions were run to determine if caregiver dosage and fidelity at post-test were predictors of child outcomes at follow-up controlling for pre-test scores.

After inspecting the data for dosage at each time point and the regression outcomes for dosage predicting child outcomes, a post-hoc analysis was conducted to examine the unique contribution of expansions to the outcomes associated with dosage. Caregiver use of expansions were examined for the total sample and for the treatment and control group at each time point and differences between groups and over time were tested using t-tests, Then, a linear regression analysis was run using raw scores for expansions at post-test to predict follow-up child outcomes.

Microsoft Excel was used to summarize descriptive data and run t-tests. SPSS was used to run correlations and linear regressions.

CHAPTER 3

Results

3.1 Reliability

Interrater reliability rating was completed on 11 transcripts (20%) and videos across timepoints for all participants. Transcripts and videos were chosen using a random number generator. Dosage interrater reliability averaged 93.56% (range 84.30-98.71%). Fidelity checklist data interrater reliability averaged 91% (range 81-100%). Sentence diversity reliability for caregivers averaged 86.55% (range 65-100%). Consensus coding was conducted on the sentence diversity coding for all children. Conceptual vocabulary interrater reliability averaged 94% (range 75-100%). Lower levels of reliability for sentence diversity and conceptual vocabulary occurred when there were few instances of the behavior being coded.

3.2 Dosage and Fidelity for the Sample

The distributions of caregiver dosage and fidelity across pre-test, post-test, and follow-up for the entire sample and for the treatment and control groups separately are displayed in Table 6. At baseline, caregivers used an average of 18.2 (*SD* = 10.24) targets within matched turns. Targets within matched turns increased at post-test (*M* = 34.29; *SD* = 20.29) and decreased at follow-up (*M* = 28.90; *SD* = 18.32). Time was significant; post-test scores were significantly higher ($p = 0.02$, $d = 0.94$) than pre-test scores. Follow-up scores were also higher than pre-test scores ($p = <0.05$, $d = 0.70$).

Caregiver fidelity increased from pre-test (*M* = 0.38, *SD* = 0.04) to post-test (*M* = 0.44, SD = 0.10) for the entire sample and remained stable at follow-up (*M* = 0.45, *SD* = 0.08). Time

approached significance from pre-test to post-test ($p = 0.08$, $d = 0.75$) and was significant from pre-test to follow-up ($p = 0.02$, $d = 1.01$) (Table 6).

3.3 Between Group Differences in Dosage and Fidelity

Table 6 displays the between group differences to address Aims 1B and 2B. There were no significant differences on any caregiver variables between groups at pre-test. Caregivers' dosage in the intervention group was significantly higher at post-test ($p = 0.02$, $d = 1.28$) and follow-up ($p = 0.01$, $d = 1.34$) than in the control group. The intervention group also had significantly higher fidelity scores at post-test ($p = < 0.01$, $d = 1.56$) and follow-up ($p = 0.02$, $d = 1.27$) than the control group.

3.4 Child Outcomes

Child data for the three outcome variables are in Table 7. There were no significant differences between groups for any variable at any timepoint. Time was significant, and the whole group demonstrated a significant increase in conceptual vocabulary from pre-test to post-test ($p = 0.002$, $d = 0.84$) and pre-test to follow-up ($p = 0.005$, $d = 0.98$). Similarly, time was significant for receptive language; scores were significantly higher from pre-test to post-test ($p = <0.05$, $d = 0.54$) and pre-test to follow-up ($p = 0.009$, $d = 0.66$). Time was only significant from pre-test to follow-up for subject-verb combinations ($p = <0.05$, $d = 0.70$). Figure 5 shows child conceptual vocabulary, subject-verb combinations, and the ROW-PVT SBE raw scores at pre-test, post-test, and follow-up for the entire sample by condition.

3.5 Dosage, Fidelity, and Child Outcomes

Table 8 displays results of the linear regression analysis predicting child outcomes at follow-up from caregiver dosage and fidelity at post-test and follow-up. Caregiver dosage of the active ingredient at post-test was a significant positive predictor of follow-up subject-verb

combinations (R^2 = .503 p = 0003) and conceptual vocabulary (R^2 =. 317 p = .026) controlling for child pre-test scores. Figure 2 shows caregiver dosage and child subject-verb combinations at pre-test, post-test, and follow-up for the treatment and control groups; figure 3 shows caregiver dosage and child conceptual vocabulary at pre-test, post-test and follow-up for the treatment and control groups.

Caregiver fidelity at post-test was a significant positive predictor of child conceptual vocabulary (R^2 = .314, p = 0.027) at follow-up controlling for child pre-test conceptual vocabulary. Figure 4 shows the relationship between caregiver fidelity and child conceptual vocabulary at pre-test, post-test and follow-up for the treatment and control groups.

Neither dosage nor fidelity predicted child receptive language at post-test or follow-up as measured by the ROW-PVT SBE raw score.

As an exploratory analysis, a linear regression was run to determine if expansions at post-test predicted conceptual vocabulary and subject-verb combinations at follow-up. Caregiver use of expansions was a significant predictor of follow-up child subject-verb combinations (R^2 = .593, p = <.001) and conceptual vocabulary (R^2 = .539, p = .001). Expansions were removed from the overall measure of dosage of the active ingredient. Once removed, caregiver dosage at post-test was still a significant predictor of child subject-verb combinations (R^2 = .397, p = .011) but was no longer a statistically significant predictor of child conceptual vocabulary (R^2 = .233, p = .066) at follow-up. Expansion descriptive statistics are in Table 9.

CHAPTER 4

Discussion

The purpose of the current study was to examine caregiver dosage of the putative active ingredient of EMT en Español (linguistic targets within matched turns), and caregiver fidelity of implementation of the intervention in relation to child language outcomes. This was the first study to examine dosage and fidelity in a study involving a caregiver-implemented NDBI with Spanish-speaking caregivers from low-income households and their young children with language delays. In this exploratory study, increased dosage of the active ingredient and higher fidelity of implementation of the intervention were related to better conceptual vocabulary scores. Dosage was also significantly related to children's sentence diversity measured as subject-verb combinations at follow-up. Caregiver dosage and fidelity in the intervention group were significantly higher than in the control group at post-test and follow-up, however child outcomes did not differ between groups. In a post-hoc analysis, expansions appeared to be a key variable contributing to the relationship between dosage and child total conceptual vocabulary.

4.1 Contributions of the Current Study

This study adds to existing research on caregiver-implemented NDBIs with Spanish-speaking families of children with language delays. The study extends current understanding of the mechanism through which caregiver-implemented NDBIs improve child language outcomes by describing the changes in dosage and fidelity and examining the associations of dosage and fidelity to child vocabulary and sentence diversity.

Following systematic training, caregivers in the intervention group demonstrated significantly increased dosage of the active ingredient and higher fidelity of the EMT en Español language intervention strategies than caregivers in the control group. This suggests that a relatively short intervention (24 sessions, 1-hr each; 20-min of active intervention delivery by the caregiver per session), provided by trained interventionists can increase caregiver use of linguistic and behavioral strategies sufficiently to improve language development measured 3-months following intervention.

For the overall group, increased dosage (measured at post-test) was associated with increases in child conceptual vocabulary and subject-verb diversity, while fidelity (as measure of quality and quantity of language supporting strategies) was significantly related to conceptual vocabulary, as measured in the proximal context of caregiver-child CCX. Increased dosage and fidelity were not associated with children's scores on a distal standardized measure of receptive vocabulary.

Given that the caregiver measures of dosage and fidelity and the child measures of conceptual vocabulary and subject-verb combinations were obtained from the same observations of caregiver and child interactions at post-test and follow-up assessment, the results should be evaluated conservatively. Potentially, children's language performance for the treatment group was positively influenced by their caregiver's increased behavioral support and linguistic input during CCX sessions (Crank et al., 2021; Provenzani et al., 2020; Sandbank et al., 2020; Yoder et al., 2013). Because caregiver and child behavior samples were not independent, there is potential for correlated measurement error (Yoder et al., 2018). Thus, no analyses of the associations between dosage, fidelity, and child outcomes within post-test and follow-up CCX observations (conceptual vocabulary, subject-verb combinations) were reported.

In the current study, caregivers maintained their use of EMT at the follow-up; dosage and fidelity were similar to the levels observed at post-test. Measuring caregiver and child behaviors at a follow up point after the post-test is especially important in research on caregiver-implemented interventions which aims to facilitate generalized changes in caregiver support for language development. Maintenance of caregiver use of EMT strategies and continued effects on child language in the current study are consistent with findings in previous studies of caregiver-implemented EMT and EMT en Español (Hampton et al., 2017; Kaiser & Roberts, 2013; Peredo et al., 2018). Such long-term effects of caregiver implemented interventions on child language have also been reported in a recent meta-analysis (Pak et al, 2023).

This pilot study was the first to examine *linguistic targets within matched turns* as a key active ingredient of an EMT-based intervention. This variable was a significant predictor of child growth in conceptual vocabulary and subject-verb diversity at follow-up, suggesting that this may be an essential strategy to teach caregivers. The exploratory analysis examining the contribution of expansions as a component of linguistic input within matched turns indicated that this specific type of caregiver linguistic input may be a critical element of the dosage measure posited to be the active ingredient. Theoretically, adult expansions of child utterances have been identified especially as an important support for child syntax development (Camarata et al., 1994). There is evidence that expansions are important for general language development in children with both typical and delayed language development (Levickis et al., 2014; Masur et al., 2005; Yoder et al., 1995) and particularly for productive language (Delehanty et al., 2023; Lugo-Neris et al., 2019). For example, in a small study with young children with autism and their parents, parent use of expansions positively predicted child expressive language (McDuffie &

Yoder, 2010). Clearly, additional studies are needed investigating the role of expansions within caregiver linguistic input as delivered in EMT and EMT en Español.

The current study used a precise and comprehensive measure of fidelity to capture the range of caregivers' behavioral and linguistic strategies that are components of EMT en Español and presumed to influence the language learning interactions between children and caregivers (Bailey et al, in review). Previous studies of EMT and EMT en Español have used more specific measures of the frequency and correct use of individual components of EMT to characterize fidelity but have not analyzed the relationship between these measures from caregivers and child outcomes. In the current study, the positive association between overall caregiver fidelity implementation of the EMT en Español intervention and child vocabulary at the post-test supports the use of multiple strategies that facilitate or enhance the impact of linguistic input on child outcomes. However, given the lack of differential effects between groups and the relatively low overall percentage of fidelity, it appears that this measure may be capturing use of general language support strategies (e.g., linguistic input, responsiveness, environmental arrangement) that were used in both treatment and control groups rather than indicating specific use of EMT strategies. Investigating the impact of other specific EMT strategies requires a sample with independent language assessments at post-test and follow-up, a larger sample of intervention and control participants, and potentially additional specific coding of these strategies.

Overall, this study provides a useful preliminary examination of the impact two key components of EMT in Español on children's language outcomes. This is an important first step in examining the underlying mechanism of change in caregiver-child interactions that may promote language development over time in children with known language delays. While dosage of target level language in matched turns was associated with more positive outcomes,

expansions appeared to be a key factor in this association. Understanding how a balance of adult linguistic input (for example, distribution of exact targets at child's production and proximal targets modeling slightly more advanced language, diversity, and overall frequency of input) and the optimal contingent relationship between child communication and caregiver input is needed to guide the development of optimal interventions and specifying caregiver linguistic input goals. The findings linking overall fidelity of the EMT en Español intervention suggest that other features of the intervention may also impact child outcomes directly or indirectly by supporting the child's communication attempts and engagement with toys, materials, and caregivers. It is possible that overall fidelity facilitates the effects of that linguistic input in matched turns has on child outcomes.

4.2 Limitations and Recommendations for Research

The primary limitation of the current study was the small sample size. There were few options to analyze the data, and t-test and regressions were the best fit. More data would have allowed greater confidence in the descriptive, correlational, and comparative analyses. Given the small sample, replication is clearly needed.

In this sample, there was considerable heterogeneity in child performance on all measures but particularly on the standardized language assessments. For example, the EOW-PVT SBE was not included in any of the statistical analysis because of floor effects at the pre-test. More than 60% of the sample did not respond on any expressive items (zero correct raw score). Given that most children did produce words in the CCX, it may be that the standardized test with an examiner was too unfamiliar or difficult for children to respond expressively compared to interactions with their familiar caregivers in a play-based interaction. Children were variable in responding on the ROW-PVT SBE as well, but a larger number of children were able to respond

to at least some receptive items. Most children had below basal values at the pre-test for the ROW-PVT SBE and thus no standardized score could be computed, and raw scores were used in the analysis. Findings from the ROW-PVT SBE should be interpreted cautiously as this measure, without the benefit of basal and standard scores, may not be a valid representation of children's receptive language.

As noted above, all child language production data came from the same CCX as the caregiver measures at the pre-test, post-test, and follow-up. This proximal measure is more likely to be influenced by what their caregivers were doing than a language sample from a blinded assessor following a standardized protocol. Given this highly proximal measure that was context bound and not an independent measure of child productive language, the results indicating relationships between caregiver dosage and fidelity and child conceptual vocabulary and subject-verb diversity need to be replicated with more distal and context independent measures (e.g., standardized language sampling and standardized tests of early language development). Independent measures would also allow for the analysis of the association of caregiver and child outcomes at post-test and caregiver and child outcomes at follow-up.

4.3 Implications for Practice

This study suggests that EMT in Español is a promising intervention for Spanish-speaking caregivers of children with language delays from low-income households. With systematic teaching and support, caregivers were able to increase their dosage of developmentally appropriate target language in matched turns and provide relatively high quality EMT en Español intervention to improve their children's spoken vocabulary and diverse sentences as assessed in a proximal context. These findings highlight the importance of systematic training for caregivers with the goal of implementing the intervention at fidelity and

concurrently increasing their use of target language in matched turns over all and use of expansions. Monitoring both fidelity and dosage is recommended as a component of caregiver training. Ongoing use of a fidelity checklist, similar to the one used in this study, is recommended to monitor both the occurrence (dosage) of specific active ingredients of the intervention and overall quality of use of EMT en Español strategies.

Caregivers in the current study demonstrated moderate maintenance of the EMT en Español strategies which may have contributed to child outcomes at follow-up. In practice, it is important to promote caregivers generalized strategy use in across routines, settings, and with other communication partners in everyday activities at home throughout training. In addition, assessing caregiver maintenance and providing additional training to sustain fidelity and dosage may be needed to sustain child language gains. The longer-term outcomes observed in this study reflect both caregivers learning the EMT en Español strategies during training, and maintaining their generalized use of the strategies after the training phase was completed.

CHAPTER 5

Conclusion

Data from this pilot study provide preliminary evidence informing understanding of the mechanism by which changes in caregiver interactions contribute to children's improved language development. This is the first study to examine dosage of a posited active ingredient, defined as the amount of target level linguistic input in matched turns, and fidelity of intervention in a caregiver-implemented NDBI for Spanish-speaking caregivers of children with language delays. Systematically teaching the EMT en Español intervention to caregivers resulted in significant changes in target level linguistic input (dosage) and language support strategies (fidelity) during interactions with their children. The dosage of linguistic targets within matched turns predicted improved vocabulary and sentence diversity over time while moderate levels of fidelity predicted child vocabulary outcomes. The findings from this study have potential importance for early intervention and clinical practice. It is essential that the study be replicated with larger samples of caregivers and to include more distal, standardized language measures to further examine the complex relationships among dosage, fidelity, and child outcomes.

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Table 1

Participant Demographics

	Intervention		Control	
Variable	N	%	N	%
Child Sex				
Male	6	60	5	50
Female	4	40	5	50
Receiving EI (Part C) Services				
Yes	9	90	8	80
No	1	10	2	20
Caregiver Education Level				
Less than high school	7	70	6	60
Completed high school	3	30	2	20
Above high school	0	0	2	20
Caregiver Country of Origin				
Mexico	7	70	5	50
U.S. (Puerto Rico)	1	10	0	0
Honduras	1	10	2	20
El Salvador	1	10	1	10
Peru	0	0	1	10
Dominican Republic	0	0	1	10

Table 2

Caregiver Use of EMT en Español Strategies in Peredo et al., 2022

Intervention Phase		Coded Behaviors
1	Setting the foundation for communication, responsive interactions, child language targets	• Percent caregiver responsiveness to child communicative turns • Percent caregiver turns that were matched to child turns • Percent caregiver utterances that included child language targets
2	Expansions	• Percent of child expandable utterances that were expanded by the caregiver
3	Communication elicitation	• Number of episodes attempted • Quality rating for each episode (range 0-3)

Table 3

Pre-test, Post-test, and Follow-up Dependent Measures in Peredo et al., 2022

Variable	Measure and Description
Caregiver Use of EMT en Español Strategies	Coded from a 15-min video recorded naturalistic play sample between the caregiver and child with a standardized set of toys and books (CCX)
Child Total Number of Words	Child's total number of words during the 15-min caregiver-child interaction with a standardized set of toys and books
Child Spontaneous Use of Words	Child's number of unprompted words during the 15-min caregiver-child interaction with a standardized set of toys and books
Bilingual Receptive Language	Standardized measure: Receptive One Word Picture Vocabulary Test-4 Spanish-Bilingual Edition (Martin, 2012)
Bilingual Expressive Language	Standardized measure: Expressive One Word Picture Vocabulary Test-4 Spanish-Bilingual Edition (Martin, 2011)

Table 4

Summary of EMT en Español Child and Adult Codes

	Code	Definition
Child Codes	No response	The child does not respond to an adult turn within 5 seconds
	No opportunity	The child has less than 5 seconds between the adult's turns
	Action	Child does a play action that the adult immediately imitates. Gestures are not actions
	Unintelligible	Child is completely unintelligible; the child is saying a word and NOT vocalizing, that one cannot understand
	Vocalization	The child only vocalizes with no secondary indicator of a specific function (e.g., gesture, such as a reach or point, trying to open something while looking at the adult)
	Code switch	The child uses an English word
	Unprompted	Non-prompted, non-imitated, non-elicited communication. This is spontaneous child language.
	Elicited	The child is using spontaneous language in response to an adult communication open prompt or cue
	Imitated	The child imitates all or part of the preceding adult communicative act (words, AAC, gesture) but does not add anything to it
	Prompted	Prompted; in response to an adult choice prompt or model prompt
	Word	Child says a word. A word does not have to be clearly articulated. If the child uses the same sounds for the same object consistently, it is considered a word
	Gesture	Child makes a gesture alone (a signal that does not refer to a specific action or object). If the child uses words and gestures, code as words

	Code	Definition
Adult Codes	No response	No response to the child's communication within 3 seconds
	No opportunity	No opportunity to respond to the child's communication
	Adult unintelligible	Adult is unintelligible
	Code switch	The adult uses an English word or utterance
	Matched turn	Adult turns that follow a child turn that are contingent and related
	Unmatched turn	Consecutive adult turns that are not preceded by child lines
	Extra turn	Appropriate unmatched adult turns taken after an interval of **5** seconds in which the child did not take either a play or verbal turn
	Expansion	The adult correctly expands the child's previous utterance
	No expansion	The adult does not expand a communicative child act that can be expanded
	Impossible to expand	The function or form of the child utterance is not possible to expand
	Target	An adult utterance at the child's target level with no extra words (articles don't count towards the number of words in the utterance)
	Not at target	The adult is not speaking using the child's target language

Table 5

Linguistic Targets within Matched Turns for a Tier 1 Child

English	Child: {points to dog} Adult: The dog is running.	In this example, the child gestures and the adult responds contingently with a *proximal target.*
	Child: block Adult: We stack the blocks.	In this example, the child says a word and the adult responds contingently with *an expansion which is also a proximal target*
	Non-example: Child: boy Adult: The boy. Adult: The blocks are falling into the road.	In this non-example, the first adult line is a matched turn with a *target.* The second adult utterance is unmatched (child does not have time to respond) and the adult's language is above target language (too complex) for a Tier 1child.
	Non-example: Child: says "woof woof" {points to a dog} Adult: Come here	In this non-example, the adult does not respond to the child's content; the adult attempts to redirect the child using non-target language.
Spanish	Child: nina Adult: La niña esta corriendo	In this example, the child says "girl" and the adult responds with a matched turn, an *expansion* which is also a proximal target "The girl is running."
	Child: (approximates "conejo") Adult: El conejo	In this example, the child attempts to say "rabbit" and the adult responds with *target* level language, "the rabbit."
	Non-example Adult: mira Child: (no opportunity) Adult: mira azul	In this non-example, the adult attempts to get the child's attention by saying "look." Without giving the child time to respond, the adult says, "look blue." This is considered an unmatched turn and below target level language for a Tier 1 child because colors labels when used alone are not considered targets.

Table 6

Caregiver Dosage and Fidelity by Group and Time

		Whole Group			Whole Group by Time		Intervention			Control			Between Groups	
		n	*M*	*SD*	*p*	*d*	*n*	*M*	*SD*	*n*	*M*	*SD*	*p*	*d*
Dosage	Pre-test	20	18.20	10.24			10	16.30	9.71	10	20.10	10.64	0.42	0.38
	Post-test	18	34.29	20.29	**0.02**	0.94	8	45.38	21.99	10	23.20	12.60	**0.02**	1.28
	Follow-up	17	28.90	18.32	**<0.05**	0.70	8	39.25	18.38	9	18.56	12.21	**0.01**	1.34
Fidelity	Pre-test	20	0.38	0.04			10	0.38	0.05	10	0.37	0.04	0.53	0.26
	Post-test	18	0.44	0.10	0.08	0.75	8	0.50	0.10	10	0.38	0.06	**<0.01**	1.56
	Follow-up	17	0.45	0.08	**0.02**	1.01	8	0.49	0.08	9	0.40	0.06	**0.02**	1.27

Note. Dosage data were raw scores (a count of the caregiver's total number of linguistic targets within a matched turn); fidelity data were percentages of items correct on the fidelity checklist. Bold indicates statistical significance at the <.05 level.

Table 7

Child Language Outcomes

		Whole Group			Whole Group by Time		Intervention			Control			Between Groups	
		n	*M*	*SD*	*p*	*d*	*n*	*M*	*SD*	*n*	*M*	*SD*	*p*	*d*
Conceptual Vocabulary	Pre-test	20	4.00	4.53			10	5	5.64	10	3	3.01	0.34	0.44
	Post-test	18	11.11	11.40	**0.002**	0.84	8	12.38	15.47	10	10.1	7.53	0.69	0.19
	Follow-up	17	16.88	18.78	**0.005**	0.98	8	20.75	22.65	9	13.44	15.11	0.44	0.38
Receptive Language	Pre-test	20	5.60	4.22			10	5.70	5.81	10	5.5	1.96	0.92	0.05
	Post-test	18	9.05	8.18	**<0.05**	0.54	8	10.50	9.04	10	7.90	7.71	0.52	0.31
	Follow-up	17	9.94	8.65	**0.009**	0.66	8	13.00	10.32	9	7.22	6.22	0.18	0.68
Subject-Verb Combinations	Pre-test	20	0.20	0.70			10	0.40	0.97	10	0	0	0.21	0.59
	Post-test	18	0.61	1.75	0.18	0.31	8	1.38	2.50	10	0	0	0.10	0.83
	Follow-up	17	2.06	3.89	**<0.05**	0.70	8	3.88	5.17	9	0.44	0.73	0.07	0.96

Note. Child receptive language as the raw score of the ROW-PVT SBE. Bold indicates significance at the .05 level. * Conceptual Vocabulary and Subject-Verb Combinations were new child variables coded for the current study.

Table 8

Post Test-Dosage, Post-Test Fidelity, and Child Outcomes at Follow-Up

	Caregiver Timepoint	Follow-Up Child Outcome Measure	R^2	*B*	*SE*	*t*	*p*
Dosage	Post-test	Subject-Verb Combinations	0.503	0.128	0.035	3.643	**0.003**
		Conceptual Vocabulary	0.317	0.495	0.199	2.491	**0.026**
		Receptive Language	0.014	0.016	0.118	0.136	0.894
Fidelity	Post-test	Subject-Verb Combinations	0.208	17.528	9.928	1.766	0.099
		Conceptual Vocabulary	0.314	107.042	43.269	2.474	**0.027**
		Receptive Language	0.068	21.625	23.581	0.917	0.375

Note. Dosage data were from raw scores (a count of the caregiver's total number of linguistic targets within a matched turn); fidelity data were percentages. Child receptive language was taken from the raw score of the ROW-PVT SBE. Separate models were run for each child outcome measure. Bold indicates statistical significance at the <.05 level.

Table 9

Caregiver Use of Expansions by Group and Time

		Whole Group			Whole Group by Time		Intervention			Control			Between Groups	
		n	*M*	*SD*	*p*	*d*	*n*	*M*	*SD*	*n*	*M*	*SD*	*p*	*d*
Expansions	Pre-test	20	1.30	1.56			10	1.40	1.51	10	1.20	1.69	0.78	0.13
	Post-test	18	4.56	4.56	**0.01**	0.98	8	4.63	3.85	10	4.50	5.25	0.96	0.02
	Follow-up	17	7.18	8.39	**<0.01**	1.02	8	10.50	10.56	9	4.22	4.71	0.13	0.79

Note. Bold indicates significance at the .05 level.

Figure 1

Dependent Variables in the Original and Current Study

Peredo et al., 2022	Current Study
Caregiver	

• Caregiver Use of EMT en Español Strategies
  • % Responsiveness
  • % Matched Turns
  • % Target Talk
  • % Expansions
  • % Time Delays and Milieu Teaching Episodes
	• Caregiver Fidelity of EMT en Español Strategies
	  • Quantitative use of EMT specific strategies from coded data + qualitative measures of other EMT related behaviors
	• Dosage of the Putative Active Ingredient
	  • Target Talk within Matched Turns

Child	
• Child Total Number of Words from CCX • Child Spontaneous Use of Words (NDW) from CCX • Bilingual Receptive Language – ROW-PVT SBE • Bilingual Expressive Language – EOW-PVT SBE	• Bilingual Conceptual Vocabulary (nouns, verbs, and modifiers) from CCX • Sentence Diversity • Unique Subject-Verb Combinations • Bilingual Receptive Language – ROW-PVT SBE

Note. ROW-PVT SBE = Receptive One Word Picture Vocabulary Test-4 Spanish-Bilingual Edition (Martin, 2012)

Figure 2

Caregiver Dosage of the Active Ingredient and Child Unique Subject-Verb Combinations at Pre-test, Post-test, and Follow-up in Intervention and Control Groups

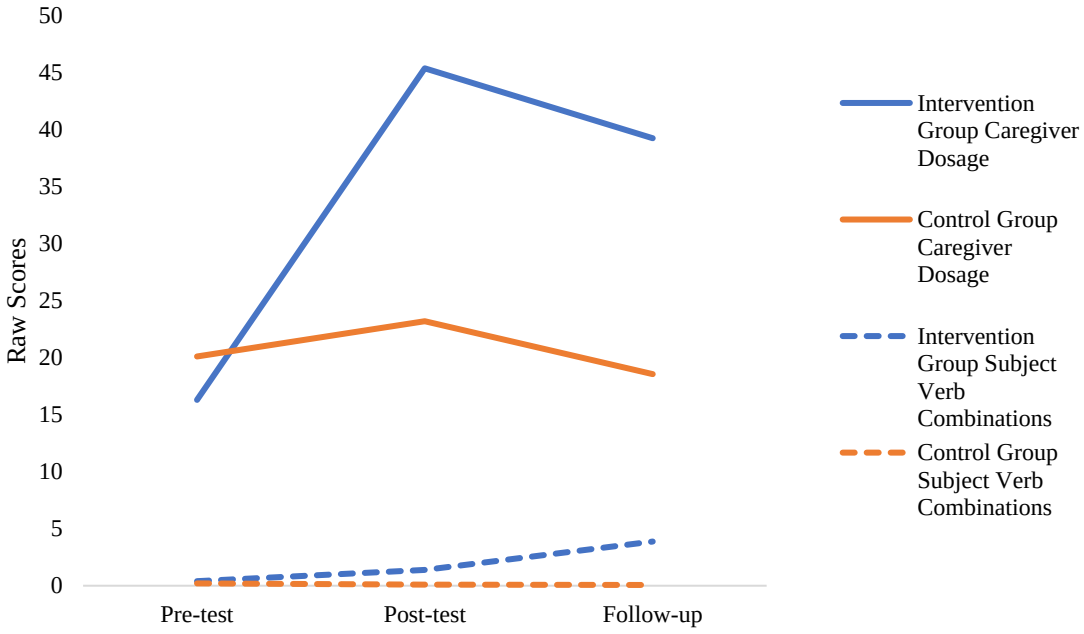


Figure 3

Caregiver Dosage of the Active Ingredient and Child Total Conceptual Vocabulary at Pre-test, Post-test, and Follow-up in Intervention and Control Groups

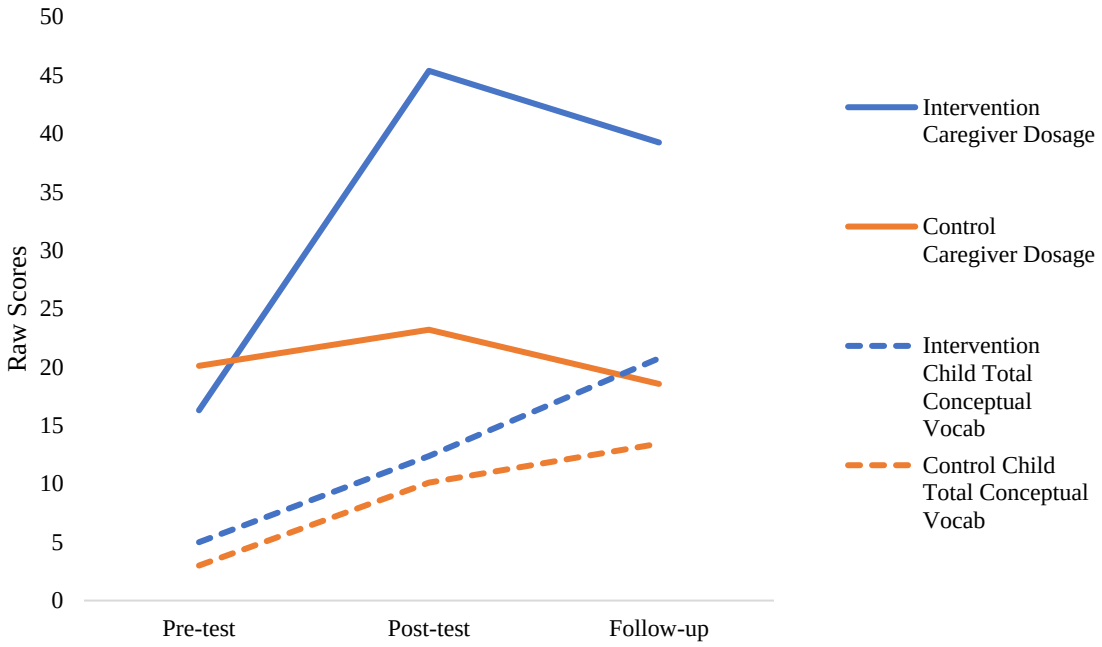


Figure 4

Caregiver Fidelity of Intervention and Child Conceptual Vocabulary at Pre-test, Post-test, and Follow-up in Intervention and Control Groups

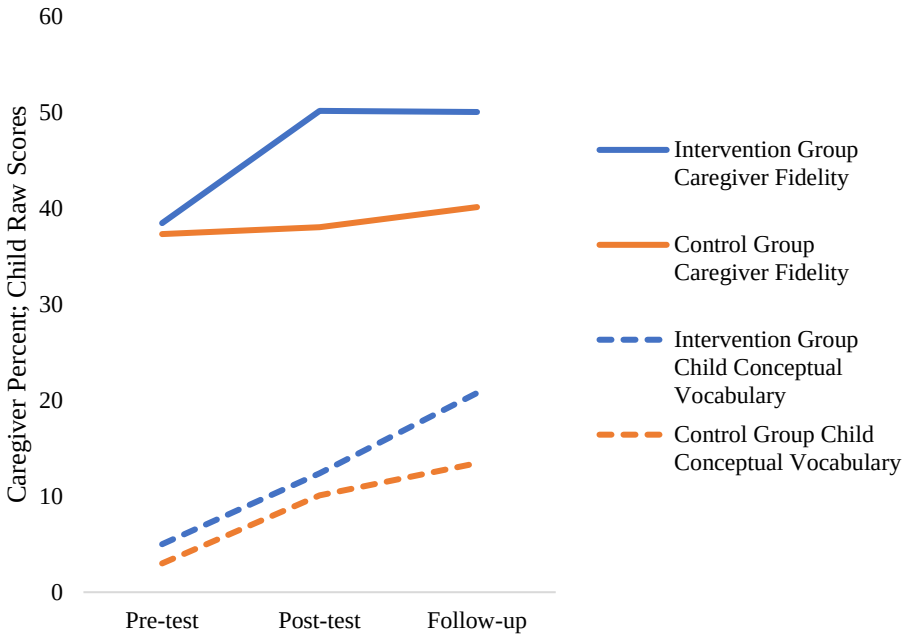
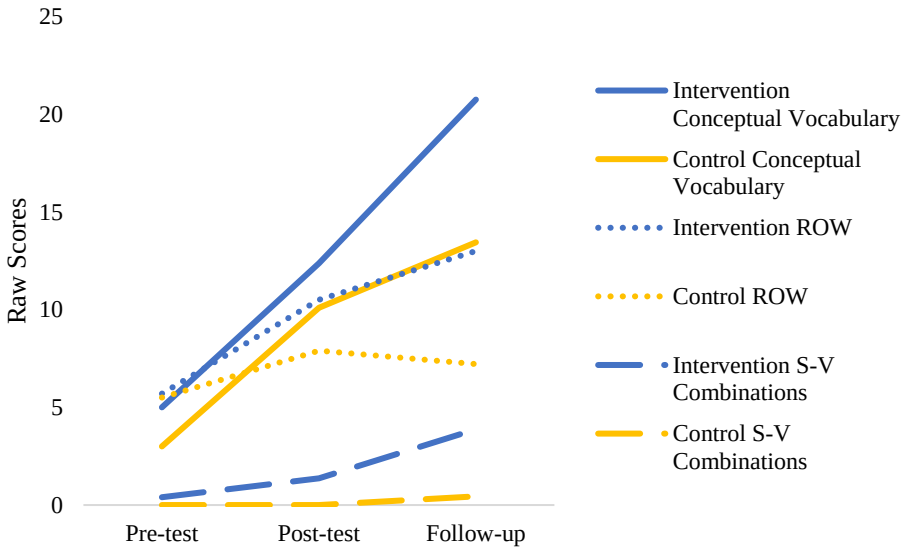


Figure 5

Child Outcomes



Appendix A

Caregiver-Child Interaction (CCX) Protocol

Introduction:
The purpose of this caregiver-child communication probe is to gather information about the caregiver's use of EMT strategies across untrained activities as well as the rate and diversity of the child's social communication skills including gestures, vocalizations, and words.
The picnic is filmed and later transcribed and coded. It is important to be able to see the child and caregiver in the video, but not be distracting of the interaction.

Length of the Assessment
The picnic should be 15 minutes in length and include caregiver (washing hands/taking shoes off), play, book, and cleanup activities.

Setting up the Assessment:

1. Show the parent the toys that are available in the kit.
2. Set up video camera and tripod so that the caregiver and child are visible.
3. Turn on the camera.
4. Read script to the caregiver.
5. Answer any questions the caregiver has and allow him/her time to get comfortable with the materials.
6. Ask the caregiver if they are ready to begin.
7. Start the timer.

During the Assessment
Do not provide coaching (praise or constructive feedback) during the picnic activity. The coach's role is to ensure that the dyad engages in each of the 4 routines categories.
If at minute 10, the child has removed shoes/hands and played, but has not looked at books, tell the caregiver "it's time to switch to books". If the child has read, but not played, cue the caregiver "it's time to play with the toys". When there is 1 minute left remind the caregiver to clean up. If the child tries to engage with you, be polite but not fun/attentive and gently guide them back to the caregiver.

Materials
The following materials are used to ensure uniformity across sites and maintain comparable assessment situations across children, it is important to use the same set of materials and toys with minimal substitutions. Materials include:

- A picnic basket
- Dishes and plastic silverware
- Toy food
- A bear (that can be fed)
- A blanket or table cloth
- 2 pair Sunglasses & 2 hats
- Hand wipes
- 2 books
- Blocks

- Ball
- Shapesorter

Say

Esta actividad durará 15 minutos y es para nosotros ver como usted y su niño se comunican. Estamos observando señas, sonidos, y palabras que _____ usa para comunicarse. Usted debe jugar y hacer las actividades con su niño como hacen normalmente si yo no tuviera aquí. Queremos observar algunas actividades diferentes entonces el pícnic tiene varias partes.

Primero empieza con retirando los zapatos de _____ y lavando sus manos con una toallita. Después, pueden jugar con los juguetes o fingir de ir de pícnic. Si _____ no se interesa por el pícnic también tenemos otros juguetes como una pelota (bola), rompe cabezas, y cubitos.
También queremos que ustedes miran un libro juntos por al menos un minuto. Y después pueden limpiar el pícnic.

Le aviso cuando se faltan 5 minutos para que pueden empezar a mirar el libro si todavía no han hecho, también le aviso cuando se faltan 1 minuto para que pueden tener un poco de tiempo para limpiar.

¿Tiene alguna pregunta sobre esta actividad? ¿Lista(o)?

Empezamos los 15 minutos.

Appendix B

EMT en Español Code

Child Codes:

Single Codes	***Independence***	***Form***
[n] – no response	[u] – unprompted	[w] – words
[o] – no opportunity	[e] – elicited	[g] – gesture
[t]- action	[i] – imitated	
[cx] – unintelligible	[p] – prompted	
[vu] - vocalization		
[cs] – code switch		

Child Single Codes:

1. **No Response [N]** = the child does not respond to an adult turn within **5 seconds**.

   Example:
   a ayuda [mt][ix][nt].
   c [n].
   a aquí [ut][ix][nt].

   Example:
   a despierta|despertar [ut][ix][at]!
   c [n].
   c {off} [t].
   a {off} arriba|| [mt][ix][at].

2. **No Opportunity [O]** = the child has less than **5 seconds** between the adult's turns.

   Example:
   a sí sabes|saber [mt][ix][nt]?
   c [o].
   a pon|poner del más grande al más chiquito|chico [ut][ix][nt].
   c [o].
   a del más grande al más chiquito|chico [ut][ix][nt].

3. **Child Action [T]:** Child does a play action that the adult immediately imitates. Gestures are *not* actions.

   Example:
   c {covers} [t].
   a {covers} tapamos|tapar [mt][ix][at].

   [t] is only used as the single code for a given utterance. If the child does an action AND says something unintelligible, code as [cx].

   Example:
   c {pretends to eat} xx [cx].
   a {pretends to eat}comemos|comer [mt][ix][at].

4. **Child Unintelligible [CX]:** Child is completely unintelligible [CX]; the child is saying a word and NOT vocalizing, that one cannot understand. This code is only used if the entire utterance is unintelligible**.**

   Example**:**
   c x [cx].

   c x elefante [u].

   Note: This code is only used if you are sure the child is intentionally trying to communicate (i.e., not vocalizing or stimming) but the words are not clear enough to be understood.
   This code can be used along with the independence code only ***IF*** the child also gestures in the utterance.
   Example:
   c {grabs} xxx [cx][u][g].

5. **Vocalization [VU]:** the child **only** vocalizes with no secondary indicator of a specific function (e.g. gesture, such as a reach or point, trying to open something while looking at the adult).
   *{sounds} e.g. sound effects are considered vocalizations and will be coded [vu].

6. **Code Switch [CS]:** The child uses an English word.
   NOTE: This is a utterance level code, which means it should be the first code at the end of an utterance if there are any English words in that utterance.
   Example:
   c xx el dog **[cs]**.
   c mira|mirar truck **[cs]**.

Independence: the level of support the child needs to communicate.

1. **Unprompted [U]:** non-prompted, non-imitated, non-elicited communication. This is spontaneous child language. If the child uses part or all of the adult's previous communication, but changes the mode of communication (i.e., adult speaks and child presses the adult's word on the AAC), it is considered [u]. If the child adds something to the adult's previous communication then it is considered [u].

If the child repeats what the adult says but it happens more than 3 seconds after the adult speaks, it is considered [u].

Example:
a perro.
c caballo [u].

Example:
a perro.
c mira|mirar el perro [u]. ←here the child expanded the previous utterance and added new language

Example:
a pelota.
c {signs ball} [u]. ←here the child changed the mode of communication to signing

Example:
a manejamos|manejar el carro.
c {five seconds after} manejamos|manejar [u]. ←here more than 3 seconds have passed which moves the child's communication into unprompted

2. **Prompted [P]:** prompted; in response to an adult choice prompt or model prompt. Child utterances in response to a time delay do **not** count as prompted.

Example*:*
a di|decir perro.
c perro [p].

Example*:*
a comemos|comer sandia o comemos|comer pan?
c comemos|comer pan [p].

3. **Imitated [I]:** the child imitates all or part of the preceding adult communicative act (words, AAC, gesture) but does not add anything to it. If the child adds words or changes the mode then it is [u]. The child must imitate the utterance within 3 seconds to be considered [i]. If the child repeats any or all of the previous adult utterance but it occurs *after* 3 seconds, it is considered [u]. If on the line of 3 seconds, code [i].

Example:
a perro.
c perro [i].

Example:
a {signs dog}.
c {signs dog} [i].

Example:
a comemos|comer la sandia.

c sandia [i]. ←here the child repeats *part* of the adult's utterance but does not add anything new or change the mode of communication.

Example:
a perro.
c perro camina|caminar [u]. ←here the child adds new words

Example:
a perro.
c {signs dog} [u]. ←here the child changes the mode of communication

4. **Elicted [E]:** the child is using spontaneous language in response to an adult communication open prompt or cue. Child utterances in response to any of the following will receive this code:
    a. Open Question (ME Prompt – "what do you want?")
    b. Yes/No Question ("do you want the ball?")
    c. Clarifying question ("huh?")
    d. Test Question ("what is this?")
    e. Time Delay

Examples:
a {holds up two objects}.
c {grabs} [e].

a diga|decir que queires.
c plastillina [e].

a {holds up two objects}.
c carro [e].

Time Delay: A time delay is a nonverbal way of prompting the child to request an object, action or assistance. A Time Delay occurs when an adult uses an expectant look while holding a toy out of reach, waiting to perform an action the child wants (i.e., not opening a box or not winding a toy while looking expectantly at child), or sabotaging a child's routine (i.e. stopping cars from going down the track, putting hand over ball chute, looking at child expectantly or oriented toward the child and waiting for a child to respond).

- A time delay should be overt
- A time delay must begin with the adult having the child's attention

The following are considered time delay strategies:

a. Assistance: creating a situation in which the child needs the adult's help
   Examples: Bottles, bags, jars, etc. that the child cannot open; toys the child cannot assemble alone; wind-up toys the child cannot operate
b. Inadequate portions: providing a small amount of a desired material
   Examples: Pouring a small amount of water into a tub; putting only a small ball of playdoh on the table; squirting only a tiny amount of paint in the dish
c. Choice Making: the adult holds up two options and waits from the child to communicate (this should be done without any words).

d. Waiting with routine: the adult sets up a routine modeling the target, and then waits to see if the child produces the target.
   Example: The adult and child pour beans together and the adult says "pour" after each time they pour the beans. The 3rd time, the adult holds the beans up and but does not pour the beans and looks at the child expectantly until he communicates/requests.
e. Waiting with cue: the adult sets up the environment so that the objects cue the child.
   Example: The adult holds the shoe up to the baby's foot and looks at the child expectantly until he communicates/requests.

Form: how the child is communicating.

1. **Words [W]:** child says a word. A word does not have to be clearly articulated. If the child uses the same sounds for the same object consistently, it is considered a word. If the child uses the device and speaks simultaneously, code as words. If the child uses the AAC device and then speaks, code as AAC. If the child says the words and then pushes the same words on the AAC device, code as words.

   Examples:
   c agua [w].
   c {child says "gua" for "agua"} agua [w].

2. **Gesture [G]:** child makes a gesture alone (a signal that does not refer to a specific action or object). If the child uses words and gestures, code as words. Gestures include reaches, grabs, shaking of the head, head nodding, points, shows, and gives.

   Examples:
   c {child reaches} [g].
   c {child points to apple} [g].

Adult Codes:

Single Codes	***Matched Turn***	***Expansion***	***Target***
[n] – no response	[mt] – matched turn	[yx] – expansion	[at] – target
[o] – no opportunity	[ut] – unmatched turn	[nx] – no expansion	[nt] – not a target
[ax] – adult unintelligible	[et] – extra turn	[ix] – impossible to expand	
[cs] – code switch			

Adult Single Codes:

1. **No Response [N]:** No response to the child's communication within 3 seconds (if on the line of 3 seconds, code [o]). An adult line with this code should be inserted whenever the adult fails to respond to a child utterance within 3 seconds between two child turns. On the inserted line, this code should be accompanied by either [ix] or [nx], depending on the adult's ability to expand the child's previous utterance (see **Expansions**).

   Example:
   c carro.
   a **[n][nx].**
   c tren.

   If the adult speaks next after failing to respond to a child turn within 3 seconds, insert an adult line after the child line. It is acceptable to have two adult lines in a row if the adult fails to respond to the child's communication before his/her next turn.

   Example:
   c xx.
   a **[n][ix].**
   a a qué vamos|ir a jugar [ut][ix][nt]?

2. **No Opportunity [O]:** No opportunity to respond to the child's communication. If the child says many consecutive utterances in a row without a break, insert adult lines with the code [o] between the child's utterances whenever the adult has less than 3 seconds to respond. If you are unsure about whether or not the adult had an opportunity to respond, code [o].

   Example:
   c dame.
   a [o].
   c carro.

   If another adult in the room interjects between child turns or between the child turn and the next adult turn, and the interjection makes it impossible for the adult to respond to the child within 3 seconds, insert an adult line with the code [o] (regardless of whether the child or the adult speaks next).

   Example:
   c {vocalizes}.
   =therapist talks to parent during parent session
   a [o].
   a limpia|limpiamos.

3. **Adult unintelligible [AX]:** Adult is unintelligible. The adult says something that is completely unintelligible.

   Example:
   a xxx [ax].

If the utterance contains both unintelligible and intelligible words, code **based on the intelligible language.**

Examples: a xxx [ax].
a es|ser la x [mt][nx][nt].

7. **Code Switch [CS]:** The adult uses an English word or utterance.
   NOTE: This is a utterance level code, which means it should be the first code at the end of an utterance if there are any English words in that utterance.
   Example:
   c xx el dog **[cs]**.
   c mira|mirar truck **[cs]**.

Matched Turn: Whether or not the adult's utterance was related and/or contingent to the child's previous utterance.

1. **Matched turns [MT]:** Adult turns that follow a child turn that are contingent and related. The adult utterance can contain questions and/or commands if they are contingent and related in content. If you are unsure about whether or not the turn was related and/or contingent, code [mt].

   There are two types of child turns that the adult can respond to and get a Matched Turn. One is a child communicative act. Verbal turns, AAC activation, and gestures are considered communicative, as well as vocalizations where the child is making eye contact.
   Example:
   c {gives}.
   a ayúdame|ayudar+me [mt].

   The other child turn that the adult can verbally respond to for a matched turn is a child play act. This is only considered a matched turn when the adult is "mirroring and mapping." Mirroring and mapping is an EMT strategy where the adult mimics a child play act while adding - or "mapping" - language onto it. This turn must occur directly following the child's play act. The adult can also do the action with the child with his/her hand over the child's hand.
   Example:
   c {jumps} [t].
   a {jumps} brinca|brincar [mt].

2. **Unmatched turns [UT]:**
   a. Consecutive adult turns that are not preceded by child lines.
      Example:
      a quieres|querer tomar otra o ya [ut]?
      c [o].
      a o quieres|querer jugar con tus animal/s [ut]?

   b. Adult turns that are in response to a child utterance but are not related or contingent. *Note*: this ***must*** be overt.

Example:
c quiero|quere la pelota.
a límpiate|limpiar+te las manitas|mano/s [ut].

c. Adult turns that are not within 5 seconds of the previous child utterance. *these should be preceded by an inserted adult line with the codes [n][ix] or [n][nx], depending on the adult's ability to expand the child's previous utterance. If the adult is trying to find toys to mirror/map, setting up the environment, or trying to discern what language the child used, but then expands or matches the child's previous turn, code [mt].

3. **Extra turns [ET]:** Appropriate unmatched adult turns taken after an interval of **5** seconds in which the child did not take either a play or verbal turn.
   To count as an Extra Turn [et], the adult must must:
   a) Use a Target or Proximal Target (see Adult Targets) EXCEPT in a Choice Time Delay
   b) Be talking about something related to current play
   c) Include one of the following strategies:
      a. Modeling a play action (saying "drive" while driving a car)
      b. Joint Attention (point, show, give)
      c. Choice Time Delay (see Time Delays)

   Example:
   a ponemos|poner.
   =5 seconds pass
   a {points} wow [ut]!

   Example:
   c {in} [t].
   a {in} in.
   =7 seconds pass
   a {points} carro [et].

Adult Targets: The level of language in the adult's utterance in relation to the child's target level of speech.

A "target level" is the appropriate amount of content-words that the child should be using to communicate. Target levels are set by the therapist and vary, depending on the child and his/her current level of communication. During the intervention the therapist may choose to advance the child to a higher target level, and so the child's target level may change between sessions.

1. **At Target [AT]:** An adult utterance at the child's target level with no extra words (articles don't count towards the number of words in the utterance). The utterance must be grammatically correct. Model prompts (i.e., 'say ball') are considered at target level if the adult is prompting the child's target. See **Notes** below for information about other words that do not count towards the word total.
   Examples:
   a es|ser una estufa **[at]**.

a dos es|ser el verde **[at]**.
a ábrelo|abrir+lo **[at]**.

2. **Not a Target [NT]:** The adult is not speaking using the child's target language. There are many reasons it could be considered not a target.
   When the adult does any of the following it is not a target [NT]:
   a. Using too many words
      Example:
      a vamos|ir a ver el libro un poquito|poco **[nt]**.
   b. Asking a question (when not expanding the child's attempt to ask a question)
      Example:
      a qué es|ser **[nt]**?
   c. Giving a command
      Example:
      a ponlo|poner aí **[nt]**.
   d. Using only non-content language
      Example:
      a oh **[nt]**.
      a ok **[nt]**.
      a oh, qué bonito **[nt]**.
   e. Speaking in a way that is grammatically incorrect
      Example:
      a este[EW: ésta] es|ser*{points to the stove} la estufa **[nt]**.

Expansion: The adult expands the child's communication by adding words. An expansion **must match the intent of the child**. In an expansion, the adult adds words to the child's previous utterance without changing the child's function.

1. **Expansion [YX]:** The adult correctly expands the child's previous utterance. There are two types of expansions which are coded [YX]:

   a. Word Expansion [YX]: The adult expands the child's word(s). The adult must repeat every content word in the child's previous utterance to expand. They do not have to repeat linguistic others. If the child's utterance is at target level, the adult can expand by repeating the child's utterance and adding 1-3 words.

   Any of the following are considered an expansion:

   1. Repeating what the child said and adding 1-3 words depending on the child's targets
      c ma mira|mirar
      a mira|mirar está|auxestar jugando|jugar **[yx]**.

   2. Replacing a non-specific word or linguistic other with a content word
      c uhoh
      a se||[x] cayó|caer **[yx]**.

NOTE: This does not apply to "sí" when the child is answering a question. If the child says "sí" the adult must repeat it and expand for it to count as an expansion
a resblan|resbalar?
c sí
a resbalar **[nx]**.

3. Correcting a grammatical or contextual error*
   *They cannot both correct a grammatical/contextual error AND add words
   c la caballo.
   a el caballo **[yx].**

b. Gesture Expansion [YX]: The adult expands the child's gesture. If the child uses a communicative gesture, the adult can expand by repeating or responding to the gesture and adding words up to the child's target level of words. For some gestures, the adult must imitate the gesture and pair it with a word(s) to count as an expansion; for others, the adult should expand using the appropriate responding gesture (e.g. the child gives and the adult takes the object and labels it).

Child Does	***What the adult must do to count as an expansion***
Shake head	{shake head} el carro no
Nod head	{nod heads} queiro|querer el carro
Point	{point} babe
Gestures that refer to a specific action (e.g., cut, drink)	{drinks} tomamos|tomar {cut} corta|cortar
Show	{points to object child is showing} vaca
Give	{received object from child} abre|abrir
Reach*	{reaches} elefante
Grab (from the adult, as in at the end of a choice Time Delay)	{gives} dámelo|dar+me+lo.

2. No expansion [NX]: The adult does not expand a communicative child act that can be expanded. The adult attempts to expand the child's previous utterance but changes the child's communicative function, adds too many words, OR does not repeat all of the content words in the child's utterance. If the adult only adds a linguistic other(s) to the child's previous utterance, it is not an expansion [nx]. Adding an article is *not* an expansion.
Examples:
Changing the intent and not repeating the words the child said is not an expansion:
c mira|mirar
a el oso|| **[nx]**.

Adult utterances that are too long to be targets cannot be expansions unless the child is saying something long enough that the adult adding 1-3 words makes them above target:

c xxx {points}
a {points} ello/s están|estar abajo|| **[nx].**

The adult cannot expand while answering a question.
c xxx {points} ?
a {points} sí es|ser la x **[nx]**.

3. **Impossible to expand [IX]:** It is impossible for the adult to expand the child's previous utterance. Adult utterances that do not follow child utterances (consecutive adult turns) are coded [ix]. Adult utterances that follow completely unintelligible [cx] child utterances or child vocalizations should be coded [ix]. If the child's utterance is partially intelligible, the adult should expand the word or words that are intelligible. Adult utterances that follow a child action [t] are also considered impossible to expand [ix]. Milieu prompts are also considered [ix].

Examples:
c {vocalizes}.
a pelota [ix].

c xxx [cx].
a el perro [ix].

a di|decir oso[ix].
c xx bebe [cx].
a ah sí el bebe [nx].

c {sleeps} [t].
a {sleeps} duermen|dormir [mt][ix][nt].

Examples that should NOT be coded as expansions

c {shakes head} mhmh [u][w].
a así|| no [mt][nx][nt].
Why? Adult did not imitate gesture and add a word
c {points} xxx [cx][u][g].
a {points} sí la ropa mira|mirar [mt][nx][at].
Why? Adult added too much information including non-content words and child only pointed
c una moto|| [u][w].
a ah vas|ir a comprar una moto|| [mt][yx][at].
Why? it is not what the child would have said to make his sentence longer, she would need to use the inflection he would use, e.g. "compro una moto" "quiero comprar una moto"
c huh [u][w]?
a café [mt][nx][at].
Why? impossible to expand, child asks a complete question and she responds. Questions are only expandable when the parent matches the child's intent and adds information, e.g. child lifts both arms and asks "¿está?" And parent says "¿Dónde está?"

Prompting Strategies (Coding Milieu Episodes)

Milieu episodes (prompting episodes) are a sequence of prompts often in response to the child's request, sometimes elicited by a Time Delay. Milieu episodes BEGIN when the adult does one of the following milieu teaching procedures and INCLUDES at least one of the following: open question, choice question or model prompt:

Open question: Question or statement that requires a verbal or nonverbal communicative response from the child that provides information that the adult does not already have (i.e., there is not a prescribed or "correct" answer). Not all real questions start a milieu episode. To start a milieu episode the real question must:

- Imply that the child make a request
  Example: "Which one should we use?" → open question that triggers a milieu episode
  Example: "What is your favorite color?" → open question that does not trigger a milieu episode
- Contain the words "we", "should", OR "want".
- "What do you say" will be considered an Open Prompt ONLY when it is used in response to a child request.

Open questions provide the least amount of support for the child.

Holding up a truck and an airplane and asking "¿Que quieres?" does not give the child any clue as to the name of the objects you are holding. They must understand that they have to say something in exchange for the object they desire. Then they must find the word "carro" or "avión" in their brains and bring it out as language. So even though holding up a truck and an airplane is functioning as a choice, it is the language of "¿Que quieres?" that makes that question an open question.

Choice Prompt: A choice question is an either/or question that requires a verbal or nonverbal communicative response from the child that provides information that the adult does not already have (i.e., there is not a prescribed or "correct" answer).

Choice questions provide a higher level of support for the child. Holding up a truck and an airplane and asking "Quieres el carro o el avión?" gives the child the words for the objects you are holding. This offers more support than an open question in which the language is not directly modeled for the child. It also makes it a bit more clear that the child needs to make a verbal attempt to say the name of the object they want in exchange for that object.

Model Prompt: A model prompt is a word, phrase, or sentence that the adult states with the intention that the child will imitate. The adult may say, "Di . . ." or emphatically state the word(s) to be imitated so it is clear to the child that the adult is prompting the child to imitate the words/actions. "Puedes decir…" counts as a model prompt.

Model prompts offer the most support for the child. Holding up the truck and saying "Di 'carro'" lets the child know exactly what the word is for the object you are holding and it lets them know the expectation that you want them to say that exact word in exchange for the truck.

Each milieu episode may have one or several of these techniques. If the adult is trying to get the child to produce the same or a very similar utterance it is considered to be part of the same episode. Prompts that require the same kind of information from the child are grouped into the same episode:

<u>Same Episode</u>
a ¿Que quieres?
c la pelota
a di "quiero tirar la pelota"
c queiro la pelota.

<u>Different Episodes</u>
A di vaca.
c (no response for 2 seconds)
a di helado
c NO!
a ¿que quieres?

The adult can also begin a Milieu Episode by using a Time Delay:

Time Delay: A time delay is a nonverbal way of prompting the child to request an object, action or assistance. A Time Delay occurs when an adult uses an expectant look while holding a toy out of reach, waiting to perform an action the child wants (i.e., not opening a box or not winding a toy while looking expectantly at child), or sabotaging a child's routine (i.e. stopping cars from going down the track, putting hand over ball chute, looking at child expectantly or oriented toward the child and waiting for a child to respond).

- A time delay should be overt
- A time delay must begin with the adult having the child's attention

The following are considered time delay strategies:

a. Assistance: creating a situation in which the child needs the adult's help
Examples: Bottles, bags, jars, etc. that the child cannot open; toys the child cannot assemble alone; wind-up toys the child cannot operate

b. Inadequate portions: providing a small amount of a desired material
Examples: Pouring a small amount of water into a tub; putting only a small ball of playdoh on the table; squirting only a tiny amount of paint in the dish

c. Choice Making: the adult holds up two options and waits from the child to communicate (this should be done without any words).

d. Waiting: the adult sets up a routine modeling the target, and then waits to see if the child produces the target.

Example: The adult and child cut toy foods together and the adult says "cortamos" after each time they pour the beans. The 3rd time, the adult holds the beans up and but does not cut the food and looks at the child expectantly until he communicates/requests.

Each Milieu episode is scored depending on how the episode is carried out by the adult. This score represents the quality and correctness of the episode. There are 9 quality indicators of the milieu episode (described more fully below), with each indicator receiving 0 to 2 points (for a maximum score of 10).

There are 3 types of episodes:

1. Milieu episodes that require a child verbal response and is in response to a request [me]

2. Milieu episodes in which the child loses interest [mli]. To be coded as [mli], the child must have requested the object or action at some point during the episode. To be coded as [mli] the adult must also not give the object that was being prompted (since the child lost interest). These episodes do not receive a score.

3. Milieu episodes in which the child never had interest and then the adult intentionally abandons the episode ***after only one prompt*** because they have realized that the child isn't interested [mac]. To be scored as [mac – milieu abandoned correctly], there must be a secondary adult behavior (e.g., shakes head, says "you don't want …", the trainer interrupts the episode and the parent stops prompting). To be coded as [mac] the adult must also not give the object that was being prompted (since the child never had interest). If the child does not request and the adult abandons after giving more than one prompt, score the episode as normal – it cannot be a [mac]. If the child does request and the adult starts prompting about an object in which the child is not interested, the adult can prompt ***only once*** before realizing the child is uninterested and abandoning the episode [mac]. These episodes do not receive a score.

Milieu Episode Scoring

Milieu Episode scores go on a separate line in the transcript. When scoring a milieu episode, insert a line on the transcript after the last adult utterance involved in the episode (e.g. labeling the object/action).
Example:
a di|decir carro.
c {grabs}.
a di|decir carro.
c carro.
a carro {gives}.
+[me3]

Milieu Episode Scoring Guidelines
Outstanding Performance **+[me3]**
The adult demonstrates a high-quality Milieu Episode. The adult must: 1. Begin the Milieu Episode naturally and in response to a non-target child request. 2. Prompt a language target at the child's target level. 3. Prompt the same words throughout the episode. 4. Use the correct prompting sequence. 5. Give the child adequate time to respond. 6. Stop prompting when the child loses interest, says the prompted words, or responds to an open question with a target request. 7. Give the child the prompted and requested object/action at the end of the Milieu Episode. 8. Label the object/action with the prompted language target.
Not Great Teaching **+[me2]**
The adult demonstrates a Milieu Episode with one of the following issues: 1. Begins the Milieu Episode at a time when the child is NOT requesting. 2. Prompts below the child's target level or using a non-target word. 3. Does not model target language when ending the episode (giving the object/action). The adult ends at the Time Delay with one of the following issues: 1. Does not wait for a clear request. 2. Gives the requested object/action before using a language target.
Confusing to the Child **+[me1]**
The adult demonstrates a Milieu Episode with one of the following issues: 1. Changes the prompted words during the Milieu Episode. 2. Uses the incorrect prompting sequence 3. Gives the object inappropriately or loses control of the object. The adult ends at the Time Delay with one of the following issues: 1. The adult does not label the requested object/action with a language target OR does not repeat/expand when the child requests using a language target. 2. CHOICE ONLY – does not present two objects that have distinctly different language targets at the child's target level.
Punishing to the Child **+[me0]**
The adult demonstrates a Milieu Episode with one of the following issues: 1. Prompts above the proximal target level. 2. Continues prompting after the child responds with the prompted words. 3. Continues prompting after the child has lost interest in the prompted object/action. 4. Begins the Milieu Episode in response to a child target request.

5. Does not give the object at the end of the episode. 6. Does not give the child adequate time to respond. 7. The Milieu Episode begins in a way that is NOT natural and disrupts play. The adult ends at the Time Delay and has one of the following issues: 1. The time delay is NOT natural and interrupts play. 2. The adult does not give the requested object/action to the child at the end of the Time Delay.
Child Loses Interest **+[mli]**
The child loses interest in the object/action and the adult abandons the Milieu Episode appropriately by not giving the child the prompted object/action.
Milieu Abandoned Correctly **+[mac]**
The child was NEVER interested in the Milieu Episode, and the adult realizes it after ONE PROMPT and abandons the episode appropriately by not giving the prompted object/action.

Outstanding Performance [me3]

1. **Begins the Milieu Episode naturally and in response to a <u>non-target</u> child request.** The episode must begin naturally, in such a way that it does not disrupt play. The adult should not do anything to demand the child's attention, such as taking away toys, clearing play space, etc.
   The episode should also begin in response to a <u>non-target</u> child request. If the child is requesting using a target, there is no reason to prompt them. If the child does not want whatever you are prompting, there is also no reason to prompt them.

2. **Prompts a language target at the child's target level.** The adult should prompt a language target at the child's target level to teach the child the language target. Targets are chosen by the therapist for the child and vary between children (see **Adult Target**).

3. **Prompts the same words throughout the episode.** The adult should not change the words they are prompting within an episode because this is confusing to the child. This includes adding or taking away words between prompts. This only applies to Choice Prompts and Model Prompts. The wording of the choices should match the wording of the Model prompt.
   Examples:
   (1-word targets)
   a pelota o carro?
   c {grabs car}.
   a di|decir carro.

   (2-word targets)
   a ¿quieres|querer la casa o quieres el carro?
   c carro.
   a di, quiero|querer el carro.

4. **Uses the correct prompting sequence.** The prompting sequence is as follows: Open Question→Choice Prompt → Model Prompt (Say prompt).
   The adult is not required to use all of these options, but they cannot be used out of this order (e.g. model prompt → open question). The adult also may not use more than 2 prompts in each category.
   If the child does not respond to an Open Question and/or Choice Prompt with the prompted target, then the adult **must** give at least one Model Prompt.
   If the child does not respond to the first Model Prompt with the prompted target, the adult **must** give the Model Prompt a second time.
   If the child does not say all of the correct speech sounds (e.g., "ca" for cat), the adult has the option of giving the model procedure again, or phonologically recasting/expanding.

5. **Gives the child adequate time to respond.** The adult must give the child at least **3 seconds** to respond after <u>all prompts</u>. This applies only to prompts – non-prompt questions such as "what color is this" do not count as prompts and it does not matter if the adult waits 3 seconds after these utterances.

6. **Stops prompting when the child loses interest, says the prompted words, or responds to an open question with a target request.** This is a measure of "over-prompting." The child needs to learn to respond to prompts in order to receive a desired object – if the adult continues to prompt beyond the expected number of prompts, this will frustrate the child. The same is true if the child says the words the adult prompts and the adult continues to prompt.
   It is also counterproductive to continue to prompt an object/action that the child no longer desires – the child will have no motivation to respond to the prompts. This is where control of the item is important – if the child is able to take the desired object before the end of the episode, he will have no motivation to respond to the prompts since he already has his reward.

7. **Gives the child the prompted and requested object/action at the end of the Milieu Episode.** The adult must give the child the prompted and requested action or object regardless of whether they completed the prompting sequence correctly.
   They should only give the object if the child shows interest in the object or action.
   If the episode does not begin in response to a request for an object/action, and the adult prompts an object/action, the child must show overt interest in the prompted object/action (reach, point, give) or respond with the prompted word(s) for the adult to correctly give the prompted object/action at the end.
   If the adult goes through the entire prompting sequence they should give the prompted object/action unless the child is blatantly uninterested.
   The adult should give the prompted & requested object/action within **2 seconds** of ending the episode unless the adult is physically having trouble doing so (ex: the child wants the jar open and it takes the adult more than 2 seconds to open it).

8. **Labels the object/action with the prompted language target**. The adult must end the episode by labeling the prompted and requested object/action with the prompted language target within one second of intentionally giving it. The language used by the adult to end the episode should be based on how the child responds to the episode. Follow the flowchart below to determine how the adult should end the episode. If the adult does something not listed, the episode should not be scored [me3].

    1. **Begins the Milieu Episode at a time when the child is NOT requesting.** If the child is not requesting, and the adult begins a Milieu Episode, it is considered not great teaching [me2]. This is because the point of Milieu Episodes is to use opportunities when the child is requesting with below-target-level language to teach them targets. The child's desire for an object/action motivates them to respond and receiving the object/action at the end of the episode reinforces them for responding or at least acquiescing to prompting.

    2. **Prompts below the child's target level or using a non-target word.** If the adult prompts a below target or non-target word (such as a linguistic other) it is considered not great teaching [me2] because it is not helpful to teach the child non-target words. This is different from prompting above-target level words because below and non-target words are not necessarily more difficult for the child to say, they are just not as useful as targets are for the child to learn.

    3. **Does not model target language when ending the episode.** If the adult does not model target language at the end of the Milieu Episode it is considered not great teaching [me2] because they are not teaching the child a language target.

Confusing to the Child [me1]

1. **Changes the prompted words during the Milieu Episode.** This only applies to Choice Prompts and Model Prompts. If the adult only asks an open question, this is not applicable. If the adult adds or takes away any words between prompts, score **[me1]**.
   Example:
   a say doll/s.
   c x.
   a say want the doll/s.

2. **Uses the incorrect prompting sequence.** The prompting sequence is as follows: Open Question→Choice Prompt → Model Prompt (Say prompt).
   The adult is not required to use all of these options, but they cannot be used out of this order (e.g. model prompt → open question). The adult also may not use more than 2 prompts in each category.
   If the child does not respond to an Open Question and/or Choice Prompt with the prompted target, then the adult must give at least one Model Prompt.
   If the child does not respond to the first Model Prompt with the prompted target, the adult must give the Model Prompt a second time.

If the child does not say all of the correct speech sounds (e.g., "ca" for cat), the adult has the option of giving the model procedure again, or phonologically recasting/expanding.

If the adult goes out of the above order, score **[me1].**
If the adult uses more than 2 prompts in a category, score **[me1].**
If the adult fails to give 2 Model Prompts when required, score **[me1].**
If the adult starts the episode with a yes/no question, score **[me1].**
If the adult uses a yes/no or test prompt, score **[me1].**

If the adult starts an episode with a yes/no or a test question they do not get credit for following the correct prompting sequence. The same is true if they insert a faux *prompt* yes/no question into the milieu episode; however, do not penalize the adult if they are merely responding to the child within the episode.
Example:
a what is this?
a say elephant. –
+**[me1]**

a do you want the puzzle?
c {nods}.
a say puzzle. –**[me1]**

3. **Gives the object inappropriately or loses control of the object. .** The adult must give the child the prompted and requested action or object regardless of whether they completed the prompting sequence correctly. They should only give the object if the child shows interest in the object or action. If the episode does not begin in response to a request for an object/action, and the adult prompts an object/action, the child must show overt interest in the prompted object/action (reach, point, give) or respond with the prompted word(s) for the adult to correctly give the prompted object/action at the end. The adult should give the prompted & requested object/action within **2 seconds** of ending the episode unless the adult is physically having trouble doing so (ex: the child wants the jar open and it takes the adult more than 2 seconds to open it). If the adult goes through the entire prompting sequence they should give the prompted object/action unless the child is blatantly uninterested.

   If the adult gives or loses control of the prompted and requested action or object before the episode has ended, score **[me1].**
   If the child lost interest in the action or object and the adult continues to prompt and gives it anyway, score **[me1].**
   If the episode does not begin in response to a request and the adult does not give the child time to respond between the adult prompting and ending the episode, score **[me1].**

Punishing to the Child [me0]

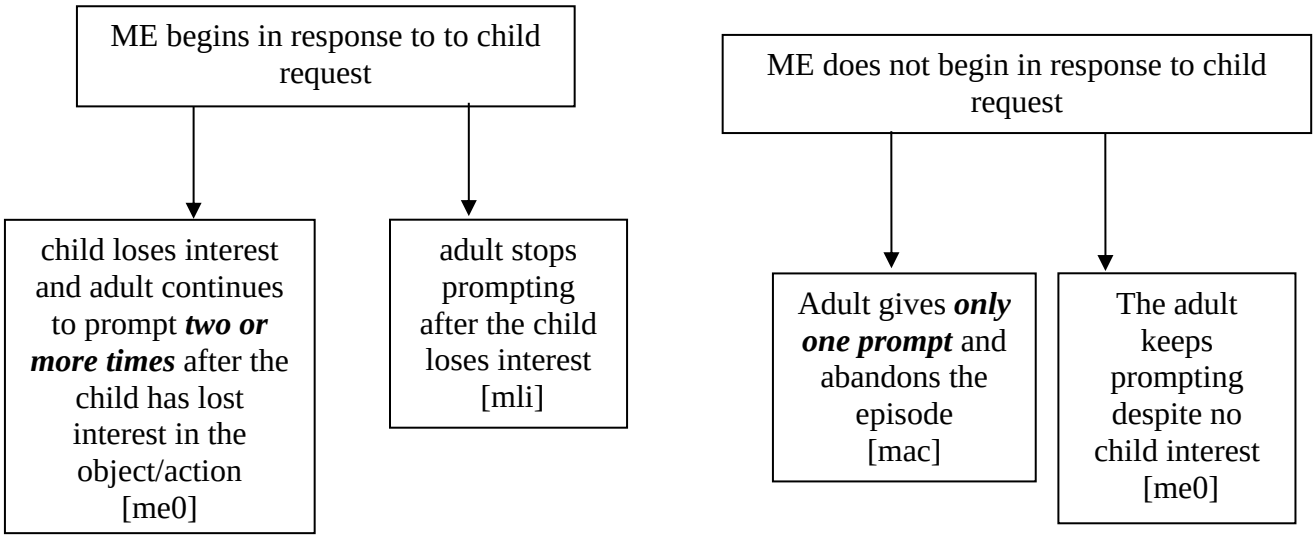
1. **Prompts above the proximal target level.** If the prompted words are more than 2 words above the child's target level, score **[me0].** The word "say" does not count.

Example:
(1-word)
a say <u>give me the red cup</u>. – **[me0]**

2. **Continues prompting after the child responds with the prompted words. Continues prompting after the child has lost interest in the prompted object/action.** This is a measure of "over-prompting." The child needs to learn to respond to prompts in order to receive a desired object – if the adult continues to prompt beyond the expected number of prompts, this will frustrate the child. The same is true if the child says the words the adult prompts and the adult continues to prompt.
   If the adult continues to prompt after the child says the prompted target, score **[me0].**

3. **Continues prompting after the child has lost interest in the prompted object/action.** It is also counterproductive to continue to prompt an object/action that the child no longer desires – the child will have no motivation to respond to the prompts. This is where control of the item is important – if the child is able to take the desired object before the end of the episode, he will have no motivation to respond to the prompts since he already has his reward.
   If the adult continues to prompt after the child does not remain interested in the object or action being prompted, score **[me0].**
   If the child gains control of the object/action and the adult continues to prompt, score **[me0].**

   Use the following flowchart to decide if it should be scored [me0], [mli], or [mac].



4. **Begins the Milieu Episode in response to a child <u>target</u> request.** If the child is requesting using a target, there is no reason to prompt them. This only applies to language targets at the child's current target level. Language targets are child-specific and each child may have words that do not count as targets at his/her level, as specified by the therapist.

If the child uses a language target to request and the adult begins a Milieu Episode, score **[me0]**.

5. **Does not give the object at the end of the episode.** If the child requests the object/action at the beginning of the ME or becomes interested in the prompted object/action during the episode, and the adult does not give the object/action, score **[me0]**.

6. **Does not give the child adequate time to respond.** The adult must give the child 3 seconds to respond between prompts. This only applies to ME prompts, not to yes/no questions or any other turns the adult may take during the ME. If the adult does not give the child 3 seconds to respond after a ME prompt, score **[me0]**.

7. **The Milieu Episode begins in a way that is NOT natural and disrupts play.** The initiation of episodes that *overtly* disrupt the interaction or involve hoarding of toys or taking toys away from the child should be scored [me0]. This is a measure of the initiation of the episode; some children do not respond well to prompting and the episode itself will be disruptive because the child does not like being prompted. This is not a measure of the child's response – it is a measure of if the episode flows naturally with the play.
   Examples:
   The adult takes the Mr. Potatohead hat out of the child's hand and holds it up to Mr. Potatohead and waits – disruptive **[me0].**
   While the child is playing, the adult clears the table of all toys and holds up two choices – hoarding **[me0].**

Appendix C

Child Tier Level Descriptions

Notes:
These are general guidelines. Linguistic targets stay consistent until formally changed based on assessment data, but other strategies can change even within sessions based on child engagement.

Children's tier levels can be different for English and Spanish and are based on the child's language abilities in that language at that point in time. Linguistic targets are determined at every time point. It is possible for children to move backwards in Tiers (e.g. start at Tier 2 Spanish at t00 and be classified as Tier 1 in Spanish at t01)

	Child Characteristics	**Adult Use of Linguistic Targets** **At target = 35% of utterances** **Proximal target = 35% of utterances**	**Adult use of Strategies**
Tier 1a—building engagement to get ready to learn	Behavior characteristics Not able to attend to attend to an activity (toys or books for at least 5 minutes) without heavy support. Negative behaviors (escaping, swiping, saying "no", etc). Language characteristics Child uses less than 50 different words in the language (English or Spanish) across the 2 20-minute language samples Child's MLU is less than 1.5 in that language/ those languages across the 2 20-minute language samples	Spanish at Target Article + singular noun (common nouns) Inflected (common) verbs in the present and present progressive forms Spanish Proximal Targets Article + noun + present or present progressive verb Reflexive verb Preterit or other verb tense Verb + direct or indirect object clitic (attached or unattached) Article + noun + modifier Article + noun + common verb English at Target (if applicable) Nouns (singular and plural) English Proximal Targets (if applicable) Noun + modifier (with or without article) Simple sentences, including: Pronoun + verb (in grammatically correct tense) Article + Noun + verb (in grammatically correct tense)	Keep activities short to end with child successfully engaging Behavior strategies to build interest/ engagement First/then Timer Child specific reinforcers Focus on environmental arrangement to promote engagement (e.g. removing distractions, choosing a location to limit escaping behaviors, sitting at the table) Manipulatives to add interest in books Puppets Toys related to book Maintain a quick pace, modeling play, etc. Drop play level to make it cognitively easy and focus on length of time of engagement (e.g. add in tickles and kisses from agents when playing with agents, go under and over a blanket, play peek-a-boo, blow bubbles) Respond to all child gestures, vocalizations, and words Use Tier 1 targets (see linguistic targets) Limit questions in books and limit time delays (no prompts) Flip through pages in the book, naming and pointing to pictures (wait for better engagement before reading text)

Tier 1b—ready for vocabulary	Behavior Characteristics Can attend to book sharing and a play routine for at least 5 minutes without needing behavioral supports. *BUT Note kids can fluctuate between Tier 1b and Tier 1a even within a session (not necessarily a linear progression). Move to Tier 1a strategies as needed when interest and engagement are fragile.* Linguistic Characteristics Child uses less than 50 different words in the language (English or Spanish) across the 2 20-minute language samples Child's MLU is less than 1.5	Article + Noun + verb + object or state or location Article + Noun + state or location	Environmental arrangement Respond to all child vocalizations and words Model and expand play (horizontally and vertically) Mirror and map Use Tier 1 Targets (at Target and Proximal Targets) Expand child's utterances Read/ simplify text in books Ask simple questions in books (answers should be targets) What is it? ¿Qué es esto? ¿Qué son? What are they doing? Qué hacen los _____? ¿Qué están haciendo? Use time delay and prompting strategies in play when engagement and interest are high

Tier 2—building phrases	Behavior Characteristics Can attend to book sharing and a play routine for at least 5 minutes without needing behavioral supports. *BUT Note kids can fluctuate engagement even within a session (not necessarily a linear progression). Move to Tier 1a strategies as needed when interest and engagement are fragile. Maintain Tier 2 linguistic targets* Language Characteristics Child uses 50 or more different words (with diversity) in the language (English or Spanish) across the 2 20-minute language samples. Child's MLU is 1.5 or greater in that language/ those languages in the language samples Child has at least 4 different word combinations in that language (from language sample and/ or CCX) For Spanish, at least one example of article use and present progressive verb use from language samples and CCX	<u>Spanish at Target</u> Article + noun + present or present progressive verb Reflexive verb Preterit or other verb tense Verb + direct or indirect object clitic (attached or unattached) Article + noun + modifier Article + Obscure/elaborated Noun Article + Plural Noun Negation + Inflected Verb <u>Spanish Proximal Targets</u> Correctly inflected verbs (in any tense besides present,present progressive and preterit) Obscure verbs correctly inflected (low frequency, very specific) Article + noun + modifier + inflected verb (word order flexible) (Article + Noun +) Verb + Prepositional Phrase <u>English at Target (if applicable)</u> Noun + modifier (with or without article) Simple Active Declarative sentences, including: Pronoun + verb (in grammatically correct tense) Pronoun + verb + object Pronoun + state or location Article + Noun + verb (in grammatically correct tense) Article + Noun + copula +state or location <u>English Proximal Targets</u> Article + Noun + verb + direct object Article + Modifier + Noun + Verb Complex Active Declarative Sentences with less than 5 content words including: Compound nouns + verb Noun + Compound verbs Two verb phrases / embedded infintive clause / catenative preceding a verb	Environmental arrangement Respond to all child vocalizations and words Model and expand play (horizontally and vertically) Mirror and map Use Tier 2 Targets (at Target and Proximal Targets) Expand child's utterances Read text in books Ask questions in books (answers are targets) What is it? ¿Qué es esto? ¿Qué son? What are they doing? Qué hacen los _____? ¿Qué están haciendo? Use time delay and prompting strategies in play when engagement and interest are high

Appendix D

Summary of Updated EMT en Español Code

Child Codes	
Behavior	**Description**
Independence	The level of support needed to communicate. The codes range from unprompted (spontaneous) to prompted (in direct respone to an adult prompt).
Communicative Form	The form of the child's communication. For the purposes of this code, only words and communicative gestures are coded.
Language Targets	The level of language used by the child in relation to the child's targetted language level. Targets are determined by the child's current level of communicative ability.
Non-response and opportunity to respond	Whether the child had enough time between the adult's communicative turns to respond, and if they did not respond when given time.
Unintelligibles and Vocalizations	Child attempts at communication that are either unintelligible or only contain vocal overtones with no attempted words.
Linguistic Errors and Code Switching	Codes designed by SALT to measure linguistic errors and code switching between languages.

Adult Codes	
Behavior	**Description**
Matched Turns and Pacing	Whether the adult's turn was "matched" (in response to) a child communication turn or a play act that the adult is using to model language, and how the adult paces their communicative turns when not responding to the child.
Language Targets	If the language in the adult's communicative utterance is a language target for the child. Targets are determined by the child's current level of communicative ability (target language, proximal target language, not at target language).
Language Expansions	How the adult expanded the child's language when possible. Expansions may include adding language to the child's utterance and providing different conjugations for verbs used by the child.

Behavior	Description
Responsiveness and opportunity to respond	Whether the adult had enough time between the child's communicative turns to respond, and if they did not respond when give time.
Linguistic Errors and Code Switching	Codes designed by SALT to measure linguistic errors and code switching between languages.
Time Delay Scores	How well the adult executed non-verbal prompting sequences.

Appendix E

Fidelity Checklist Measure for Caregiver Delivery of EMT en Español

Item Number	Item Criteria	Scores
	Environmental Arrangement and Engagement	
1	The caregiver sets up a play and book sharing space to optimize child engagement. For children who can easily engage in play and books this can be an open space on the floor, for those having difficulty with engagement this might be sitting at a table, in between options may be arranging body positioning/ toys to minimize space to wander/ distractions, moving to a corner of the room, etc. The caregiver changes the physical space during the session if needed.	1 = yes 0 = no
2	The caregiver sits within 3 feet from the child and stays at the child's level for the majority of the session. The child may also be in the caregiver's lap if not distracting.	1 = yes 0 = no
3	The caregiver removes distractions and unused materials.	1 = yes 0 = no n/a
4	The caregiver uses positive behavior support measures if necessary. These may include timers, first-then board, redirecting, etc.	1 = yes 0 = no n/a
5	The caregiver uses strategies to re-engage the child when necessary. These can include bringing objects (puppets, other toys/ materials) into book sharing, adding in a song or a person engagement game (e.g. tickles, peek-a-boo) in book or play, dropping/ simplifying play level, and modeling new play.	1 = yes 0 = no n/a

Item Number	Item Criteria	Scores
6	The caregiver physically interacts with the materials the child is playing with and engages in child's activity with the toy for the majority of the session (rate for play only)	1 = yes 0 = no
7	The caregiver uses language to be playful and to engage, redirect, provide behavioral expectations 30% or less of the time (includes: asking the child a question, giving a play or behavioral direction, singing a song, making a sound effect, etc)	1 = yes 0 = no
8	Rate for play: The caregiver only mirrors and maps language onto play acts that are functional and appropriate for the majority of the session.	1 = yes 0 = no
9	The caregiver uses language and inflection in a way that mirrors typical conversation, avoiding speech patterns that are robotic, monotone, or sing-songy for the majority of the session.	1 = yes 0 = no
Modeling Target Language (8 points total)		
11	The adult uses Spanish throughout the session with minimal code switching. Check SALT [cs] codes.	1 = yes 0 = no
12	The caregiver responds within 2 s to all child communicative attempts (vocalizations, gestures, signs, approximations, words) with a related response or repeats the child's utterance. Check SALT codes.	3 = 80% or more 2 = 60–80% 1 = 40–60% 0 = less than 40%
13	The caregiver pauses for at least 3 s after the majority of utterances to give the child an opportunity to take a communication turn. Check SALT codes.	3 = 80% or more 2 = 60–80% 1 = 40–60% 0 = less than 40%

Item Number	Item Criteria	Scores
14	The caregiver models targets at the child's level for at least 35% of utterances. Check SALT codes.	1 = yes 0 = no
Expanding Language and Play		
15	The caregiver uses proximal targets for the child for at least 35% of utterances. Check SALT codes.	1 = yes 0 = no
16	The caregiver appropriately expands words the child uses at least 40% of opportunities. Check SALT codes.	3 = 40% or more 2 = 30–39% 1 = 20–29% 0 = less than 20%
Eliciting Communication		
19	The caregiver uses 1–5 high quality TDs and/or MEs in 10 minutes coded time. This can be coded NA if engagement was fragile for the entire play session but should receive a rating of 0–3 if there was any opportunity. Check coded data.	2 = 1–5 1 = >5 0 = none n/a = engagement was too fragile
20	Milieu prompting and TD episodes are high quality. Of the total number executed, what percentage were a score of 2 or greater? This can be coded NA if criteria above is met, if criteria is not met and there are no attempted episodes, code this a 0. Check coded data.	3 = 90% 2 = 80% 1 = 70% 0 = < 70% or none were attempted despite good child engagement n/a = none were attempted because engagement was too fragile

Appendix F
Correlations

Correlations

		Pre Child Age	Pre Caregiver Fidelity	Pre Caregiver Dosage Percent	Pre Caregiver Dosage Raw Score	Pre Caregiver Unique Subject-Verb Combinations	Pre Caregiver Matched Turns Percentage	Pre Caregiver Expansions Percentage	Pre Child RLT Conceptual	Pre Child ROW Raw Score	Post Caregiver Fidelity	Post Caregiver Dosage Percent	Post Caregiver Dosage Raw Score	Post Caregiver Unique Subject-Verb Combinations	Post Caregiver Matched Turns Percentage	Post Caregiver Expansions Percentage	Post Child RLT Conceptual	Post Child ROW Raw Score	FU Caregiver Fidelity	FU Caregiver Dosage Percent	FU Caregiver Dosage Raw Score	FU Caregiver Unique Subject-Verb Combinations	FU Caregiver Matched Turns Percentage	FU Caregiver Expansions Percentage	FU Child RLT Conceptual	FU Child ROW Raw Score
Pre Child Age	Pearson Correlation	1	.237	.031	.061	.104	.041	-.032	.573**	.434	.148	.212	.454	.166	.079	-.029	.253	-.213	.203	.337	.419	.202	.221	.460	.295	-.179
	Sig. (2-tailed)		.314	.897	.798	.662	.864	.896	.008	.056	.558	.398	.058	.510	.756	.916	.312	.396	.435	.185	.094	.453	.394	.084	.250	.491
	N	20	20	20	20	20	20	19	20	20	18	18	18	18	18	16	18	18	17	17	17	16	17	15	17	17
Pre Caregiver Fidelity	Pearson Correlation	.237	1	.142	.121	.078	.405	.577**	.059	.374	.225	.160	.421	.402	.043	.035	.086	.022	.023	.215	.407	.412	.551*	.303	.345	-.263
	Sig. (2-tailed)	.314		.551	.611	.743	.077	.010	.805	.104	.369	.527	.082	.098	.865	.899	.735	.930	.929	.407	.105	.113	.022	.272	.175	.309
	N	20	20	20	20	20	20	19	20	20	18	18	18	18	18	16	18	18	17	17	17	16	17	15	17	17
Pre Caregiver Dosage Percent	Pearson Correlation	.031	.142	1	.759**	-.018	.720**	.000	-.020	.079	.266	.098	.040	-.095	.116	.470	-.094	-.199	.302	.393	.267	-.079	.412	.054	.268	-.336
	Sig. (2-tailed)	.897	.551		<.001	.941	<.001	.999	.932	.740	.285	.699	.875	.707	.647	.066	.709	.429	.239	.119	.301	.772	.101	.850	.298	.188
	N	20	20	20	20	20	20	19	20	20	18	18	18	18	18	16	18	18	17	17	17	16	17	15	17	17
Pre Caregiver Dosage Raw Score	Pearson Correlation	.061	.121	.759**	1	.456*	.547*	-.151	.076	.001	.055	-.215	-.043	-.075	.128	.376	-.100	-.186	-.064	.130	.335	-.040	.405	-.021	.418	-.116
	Sig. (2-tailed)	.798	.611	<.001		.043	.013	.537	.750	.998	.829	.391	.867	.768	.614	.152	.692	.459	.806	.618	.189	.883	.107	.940	.095	.658
	N	20	20	20	20	20	20	19	20	20	18	18	18	18	18	16	18	18	17	17	17	16	17	15	17	17
Pre Caregiver Unique Subject-Verb Combinations	Pearson Correlation	.104	.078	-.018	.456*	1	-.233	-.023	.162	-.013	-.208	-.256	-.195	-.215	.304	-.332	-.395	-.228	-.267	-.267	-.052	-.123	.251	-.116	.092	.110
	Sig. (2-tailed)	.662	.743	.941	.043		.323	.926	.495	.956	.407	.305	.437	.392	.220	.209	.104	.363	.299	.300	.844	.650	.331	.681	.726	.675
	N	20	20	20	20	20	20	19	20	20	18	18	18	18	18	16	18	18	17	17	17	16	17	15	17	17
Pre Caregiver Matched Turns Percentage	Pearson Correlation	.041	.405	.720**	.547*	-.233	1	.275	-.022	.151	.430	.201	.217	.061	.107	.559*	-.044	-.149	.367	.587*	.521*	.254	.565*	.328	.368	-.253
	Sig. (2-tailed)	.864	.077	<.001	.013	.323		.255	.928	.525	.075	.425	.387	.809	.672	.024	.863	.554	.147	.013	.032	.342	.018	.233	.146	.328
	N	20	20	20	20	20	20	19	20	20	18	18	18	18	18	16	18	18	17	17	17	16	17	15	17	17
Pre Caregiver Expansions Percentage	Pearson Correlation	-.032	.577**	.000	-.151	-.023	.275	1	.193	.286	.026	-.115	-.108	.290	-.050	-.277	-.062	.089	.185	-.094	-.038	.282	.227	.193	-.112	-.103
	Sig. (2-tailed)	.896	.010	.999	.537	.926	.255		.430	.235	.920	.662	.681	.259	.850	.317	.814	.735	.493	.730	.890	.308	.398	.509	.680	.704
	N	19	19	19	19	19	19	19	19	19	17	17	17	17	17	15	17	17	16	16	16	15	16	14	16	16
Pre Child RLT Conceptual	Pearson Correlation	.573**	.059	-.020	.076	.162	-.022	.193	1	.534*	-.144	-.171	.035	.457	-.041	-.059	.270	.104	.162	.046	.148	.251	-.090	.200	.117	-.069
	Sig. (2-tailed)	.008	.805	.932	.750	.495	.928	.430		.015	.569	.496	.890	.057	.873	.829	.279	.682	.534	.862	.571	.349	.731	.476	.653	.794
	N	20	20	20	20	20	20	19	20	20	18	18	18	18	18	16	18	18	17	17	17	16	17	15	17	17
Pre Child ROW Raw Score	Pearson Correlation	.434	.374	.079	.001	-.013	.151	.286	.534*	1	.205	-.020	.367	.518*	.122	-.004	.589*	.452	.583*	.179	.361	.542*	.078	.522*	.457	.112
	Sig. (2-tailed)	.056	.104	.740	.998	.956	.525	.235	.015		.414	.937	.134	.028	.630	.989	.010	.060	.014	.491	.155	.030	.766	.046	.065	.669
	N	20	20	20	20	20	20	19	20	20	18	18	18	18	18	16	18	18	17	17	17	16	17	15	17	17
Post Caregiver Fidelity	Pearson Correlation	.148	.225	.266	.055	-.208	.430	.026	-.144	.205	1	.793**	.737**	.099	.686**	.354	.201	.239	.523*	.666**	.533*	.089	.474	.275	.518*	.257
	Sig. (2-tailed)	.558	.369	.285	.829	.407	.075	.920	.569	.414		<.001	<.001	.696	.002	.178	.423	.340	.031	.004	.028	.744	.055	.320	.033	.320
	N	18	18	18	18	18	18	17	18	18	18	18	18	18	18	16	18	18	17	17	17	16	17	15	17	17
Post Caregiver Dosage Percent	Pearson Correlation	.212	.160	.098	-.215	-.256	.201	-.115	-.171	-.020	.793**	1	.741**	-.138	.588*	.274	-.042	-.029	.410	.735**	.421	-.159	.473	.283	.235	.083
	Sig. (2-tailed)	.398	.527	.699	.391	.305	.425	.662	.496	.937	<.001		<.001	.584	.010	.305	.870	.908	.102	<.001	.093	.556	.055	.306	.364	.753
	N	18	18	18	18	18	18	17	18	18	18	18	18	18	18	16	18	18	17	17	17	16	17	15	17	17
Post Caregiver Dosage Raw Score	Pearson Correlation	.454	.421	.040	-.043	-.195	.217	-.108	.035	.367	.737**	.741**	1	.329	.424	.368	.404	.241	.380	.648**	.732**	.159	.462	.447	.555*	.074
	Sig. (2-tailed)	.058	.082	.875	.867	.437	.387	.681	.890	.134	<.001	<.001		.182	.079	.161	.096	.336	.133	.005	<.001	.555	.062	.095	.021	.777
	N	18	18	18	18	18	18	17	18	18	18	18	18	18	18	16	18	18	17	17	17	16	17	15	17	17
Post Caregiver Unique Subject-Verb Combinations	Pearson Correlation	.166	.402	-.095	-.075	-.215	.061	.290	.457	.518*	.099	-.138	.329	1	-.226	.291	.544*	.494*	.028	-.188	.107	.413	-.282	.029	.123	-.212
	Sig. (2-tailed)	.510	.098	.707	.768	.392	.809	.259	.057	.028	.696	.584	.182		.367	.274	.020	.037	.916	.470	.683	.112	.273	.918	.639	.414
	N	18	18	18	18	18	18	17	18	18	18	18	18	18	18	16	18	18	17	17	17	16	17	15	17	17
Post Caregiver Matched Turns Percentage	Pearson Correlation	.079	.043	.116	.128	.304	.107	-.050	-.041	.122	.686**	.588*	.424	-.226	1	.000	-.048	.218	.497*	.535*	.371	-.169	.478	.343	.377	.440
	Sig. (2-tailed)	.756	.865	.647	.614	.220	.672	.850	.873	.630	.002	.010	.079	.367		1.000	.851	.384	.043	.027	.142	.533	.052	.211	.135	.077
	N	18	18	18	18	18	18	17	18	18	18	18	18	18	18	16	18	18	17	17	17	16	17	15	17	17
Post Caregiver Expansions Percentage	Pearson Correlation	-.029	.035	.470	.376	-.332	.559*	-.277	-.059	-.004	.354	.274	.368	.291	.000	1	.039	.030	.118	.424	.436	.058	.067	.224	.257	-.236
	Sig. (2-tailed)	.916	.899	.066	.152	.209	.024	.317	.829	.989	.178	.305	.161	.274	1.000		.887	.912	.676	.116	.104	.845	.812	.423	.354	.397
	N	16	16	16	16	16	16	15	16	16	16	16	16	16	16	16	16	16	15	15	15	14	15	15	15	15
Post Child RLT Conceptual	Pearson Correlation	.253	.086	-.094	-.100	-.395	-.044	-.062	.270	.589*	.201	-.042	.404	.544*	-.048	.039	1	.774**	.321	.091	.303	.251	-.127	.181	.425	.358
	Sig. (2-tailed)	.312	.735	.709	.692	.104	.863	.814	.279	.010	.423	.870	.096	.020	.851	.887		<.001	.209	.728	.237	.349	.626	.518	.089	.159
	N	18	18	18	18	18	18	17	18	18	18	18	18	18	18	16	18	18	17	17	17	16	17	15	17	17
Post Child ROW Raw Score	Pearson Correlation	-.213	.022	-.199	-.186	-.228	-.149	.089	.104	.452	.239	-.029	.241	.494*	.218	.030	.774**	1	.410	-.022	.129	.108	-.153	.028	.275	.600*
	Sig. (2-tailed)	.396	.930	.429	.459	.363	.554	.735	.682	.060	.340	.908	.336	.037	.384	.912	<.001		.102	.935	.622	.690	.557	.922	.285	.011
	N	18	18	18	18	18	18	17	18	18	18	18	18	18	18	16	18	18	17	17	17	16	17	15	17	17
FU Caregiver Fidelity	Pearson Correlation	.203	.023	.302	-.064	-.267	.367	.185	.162	.583*	.523*	.410	.380	.028	.497*	.118	.321	.410	1	.601*	.402	.163	.249	.657**	.189	.283
	Sig. (2-tailed)	.435	.929	.239	.806	.299	.147	.493	.534	.014	.031	.102	.133	.916	.043	.676	.209	.102		.011	.109	.547	.336	.008	.467	.272
	N	17	17	17	17	17	17	16	17	17	17	17	17	17	17	15	17	17	17	17	17	16	17	15	17	17
FU Caregiver Dosage Percent	Pearson Correlation	.337	.215	.393	.130	-.267	.587*	-.094	.046	.179	.666**	.735**	.648**	-.188	.535*	.424	.091	-.022	.601*	1	.768**	.068	.677**	.729**	.438	.097
	Sig. (2-tailed)	.185	.407	.119	.618	.300	.013	.730	.862	.491	.004	<.001	.005	.470	.027	.116	.728	.935	.011		<.001	.803	.003	.002	.078	.712
	N	17	17	17	17	17	17	16	17	17	17	17	17	17	17	15	17	17	17	17	17	16	17	15	17	17
FU Caregiver Dosage Raw Score	Pearson Correlation	.419	.407	.267	.335	-.052	.521*	-.038	.148	.361	.533*	.421	.732**	.107	.371	.436	.303	.129	.402	.768**	1	.405	.622**	.698**	.752**	.228
	Sig. (2-tailed)	.094	.105	.301	.189	.844	.032	.890	.571	.155	.028	.093	<.001	.683	.142	.104	.237	.622	.109	<.001		.119	.008	.004	<.001	.379
	N	17	17	17	17	17	17	16	17	17	17	17	17	17	17	15	17	17	17	17	17	16	17	15	17	17
FU Caregiver Unique Subject-Verb Combinations	Pearson Correlation	.202	.412	-.079	-.040	-.123	.254	.282	.251	.542*	.089	-.159	.159	.413	-.169	.058	.251	.108	.163	.068	.405	1	-.099	.594*	.430	.113
	Sig. (2-tailed)	.453	.113	.772	.883	.650	.342	.308	.349	.030	.744	.556	.555	.112	.533	.845	.349	.690	.547	.803	.119		.716	.025	.097	.676
	N	16	16	16	16	16	16	15	16	16	16	16	16	16	16	14	16	16	16	16	16	16	16	14	16	16
FU Caregiver Matched Turns Percentage	Pearson Correlation	.221	.551*	.412	.405	.251	.565*	.227	-.090	.078	.474	.473	.462	-.282	.478	.067	-.127	-.153	.249	.677**	.622**	-.099	1	.365	.457	.029
	Sig. (2-tailed)	.394	.022	.101	.107	.331	.018	.398	.731	.766	.055	.055	.062	.273	.052	.812	.626	.557	.336	.003	.008	.716		.181	.065	.911
	N	17	17	17	17	17	17	16	17	17	17	17	17	17	17	15	17	17	17	17	17	16	17	15	17	17
FU Caregiver Expansions Percentage	Pearson Correlation	.460	.303	.054	-.021	-.116	.328	.193	.200	.522*	.275	.283	.447	.029	.343	.224	.181	.028	.657**	.729**	.698**	.594*	.365	1	.320	.113
	Sig. (2-tailed)	.084	.272	.850	.940	.681	.233	.509	.476	.046	.320	.306	.095	.918	.211	.423	.518	.922	.008	.002	.004	.025	.181		.245	.688
	N	15	15	15	15	15	15	14	15	15	15	15	15	15	15	15	15	15	15	15	15	14	15	15	15	15
FU Child RLT Conceptual	Pearson Correlation	.295	.345	.268	.418	.092	.368	-.112	.117	.457	.518*	.235	.555*	.123	.377	.257	.425	.275	.189	.438	.752**	.430	.457	.320	1	.368
	Sig. (2-tailed)	.250	.175	.298	.095	.726	.146	.680	.653	.065	.033	.364	.021	.639	.135	.354	.089	.285	.467	.078	<.001	.097	.065	.245		.146
	N	17	17	17	17	17	17	16	17	17	17	17	17	17	17	15	17	17	17	17	17	16	17	15	17	17
FU Child ROW Raw Score	Pearson Correlation	-.179	-.263	-.336	-.116	.110	-.253	-.103	-.069	.112	.257	.083	.074	-.212	.440	-.236	.358	.600*	.283	.097	.228	.113	.029	.113	.368	1
	Sig. (2-tailed)	.491	.309	.188	.658	.675	.328	.704	.794	.669	.320	.753	.777	.414	.077	.397	.159	.011	.272	.712	.379	.676	.911	.688	.146	
	N	17	17	17	17	17	17	16	17	17	17	17	17	17	17	15	17	17	17	17	17	16	17	15	17	17

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).