

Symposium Title: Parent-Child Interactions: Implications for Social-Communication Intervention and Treatment in Down Syndrome

Chair: Susan J. Loveall¹

Discussant: Leonard Abbeduto²

Overview: Individuals with Down syndrome (DS) exhibit unique social-communication profiles, and often struggle with aspects of these skills relative to individuals with other intellectual and developmental disabilities (e.g. Abbeduto et al., 2007). Caregivers are perhaps best positioned to support development across these domains because they can be trained and coached to provide consistent and natural learning environments that scaffold and maximize linguistic and social growth. This symposium will present current research on parent-child interactions in DS and how they may shape different social-communication outcomes. The first presentation examines joint engagement, an important precursor for successful social interactions and language development, during mother-child play and how this relates to language development in toddlers with DS. The second presentation examines the home literacy and language environments of infants and toddlers with DS and how this impacts vocabulary development both concurrently and 6 months later. The third presentation examines mother-child talk about mental states during shared storytelling and its role in language and socioemotional development of school-age children with DS. The final presentation is a systematic review of parent-child interventions to promote communication outcomes in children with DS ages birth to 6 years. Together, these presentations provide an overview of parent-child interactions in DS and highlight the potential for parent-implemented interventions and treatments.

References/Citations:

- Abbeduto, L., Warren, S. F., & Conners, F. A. (2007). Language development in Down syndrome: From the prelinguistic period to the acquisition of literacy. *Mental Retardation and Developmental Disabilities Research Reviews*, 13, 247-261.

Paper 1 of 4

Paper Title: Joint Engagement and Early Language in Toddlers with Down Syndrome

Authors: Laura J. Mattie³ & Daniela Fanta Alarcon³

Introduction: Early social strengths are a hallmark feature of the DS behavioral phenotype. These strengths likely serve as a foundation for language acquisition (Abbeduto et al., 2001), but there has been little research examining this relation in later language development. One way to characterize early social skills is to examine a child's engagement with people, objects, and events in a naturalistic interaction. Joint engagement, a child's engagement with a caregiver around an object, is often an intervention target due to its long-term effects for language outcomes (Kasari et al., 2006; 2012). The developmental progression of joint engagement indicates that children first use supported joint engagement, in which caregivers provide scaffolding to support the child's shared engagement in an object. As children gain more skills, they begin to take an active role engaging with the caregiver and the object, known as coordinated joint engagement. Several studies have indicated that young children with DS spend more time during interactions with a caregiver in supported versus coordinated joint engagement but with increasing skills in both areas overtime (Adamson et al., 2009; Legerstee & Weintraub, 1997; Lewy & Dawson, 1992). The current study seeks to expand our understanding of joint engagement and early language abilities in DS.

Methods: Participants were 15 infants and toddlers with DS. At Time 1, infants and toddlers were between 11-24 months, and at Time 2, they were between 16-30 months. Using a joint engagement-coding scheme (Hahn et al., 2016) based on the work of Adamson and Bakeman (1984), children's joint engagement was examined during a 15-minute free play with their mothers at both time points. Data were coded for the child's amount of time spent unengaged or engaged with a person, object, or jointly engaged with a person and object (i.e., in supported joint engagement or coordinated joint engagement). Here we present the preliminary results of the data that have been coded to date. The remaining participants are currently being coded; coding was

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delayed due to COVID-19. As part of a larger battery, children were administered the Mullen Scales of Early Learning (MSEL; Mullen, 1995) and mothers completed the MacArthur-Bates Communication Inventory (CDI; Fenson et al., 2006) and the Vineland Adaptive Behavior Scales-3 (VABS; Sparrow et al., 2016). We chose to examine language from these three measures to account for developmental language (MSEL), functional language (VABS), and vocabulary (CDI) both concurrently and predictively (i.e., joint engagement at Time 1 to language measures at Time 2).

Results: At Time 1 ($n = 13$) and Time 2 ($n = 9$), children with DS spent the most time in supported joint engagement followed by object engagement with little time spent in the other engagement states, including coordinated joint engagement. Children with DS spent significantly more time in supported joint engagement than in object engagement at both time points (Time 1: $t(12) = -4.88, p < .001$; Time 2: $t(8) = -5.31, p = .001$). We focused our examination of language to object engagement, supported joint engagement, and coordinated joint engagement. No significant concurrent relationships were found at Time 1 between engagement and language outcomes. At Time 2, object engagement was negatively correlated with receptive and expressive language raw scores on the VABS (receptive: $r = -.63, p = .07$, expressive: $r = -.68, p = .043$), and supported joint engagement was positively correlated with expressive language raw scores on the VABS ($r = .66, p = .052$). Looking predictively, supported joint engagement was negatively related to number of words produced on the CDI at ($r = -.68, p = .044$) and coordinated joint engagement was negatively related to expressive language raw scores on the MSEL ($r = -.68, p = .045$).

Discussion: Understanding the early language profile in DS can help to determine the roots of the expressive language deficits in later development (Fidler et al., 2007; Luyster et al., 2011) as well as identify areas for early language interventions in this population. Our results are consistent with previous studies of joint engagement in DS, indicating that children with DS are spending more time in supported joint engagement than other engagement states. One important consideration for future research is to examine when children with DS move to using coordinated joint engagement. This would provide important information about the consolidation of these skills and more reciprocal interactions with communication partners, which could be leveraged in interventions. Further, a shift to increased use of coordinated joint engagement may have greater impact on language development. Nonetheless, our results suggest that supported engagement does influence language abilities, such that more use of supported joint engagement at Time 2 is concurrently related to higher expressive language raw scores on the VABS and less supported joint engagement at Time 1 is related to more number of words produced at Time 2. Despite extant research on the role of object exploration and receptive language development, our results indicate that more object engagement is related to lower expressive and receptive language. Together these results highlight the importance of teaching parents to be responsive during interactions with their child to move them into both supported and coordinated engagement, which in turn may foster language development.

References/Citations:

- Adamson, L. B., Bakeman, R., Deckner, D. F., & Ronski, M. (2009). Joint engagement and the emergence of language in children with autism and Down syndrome. *Journal of Autism and Developmental Disorders, 39*(1), 84–96. <https://doi.org/10.1007/s10803-008-0601-7>
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Paper 2 of 4

Paper Title: Home-Literacy Environments, Shared Book Reading, and Receptive Vocabulary Development in Infants and Toddlers with Down Syndrome

Authors: Susan J. Loveall¹, Madison S. Dulin⁴, & Laura J. Mattie³

Introduction: Rich home-literacy environments (HLEs), such as providing regular access to books and engaging in parent-child shared book reading, have a positive impact on children's language and literacy development (e.g. Bus et al., 1995). However,

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despite the well-documented difficulties with speech and language in DS (e.g. Abbeduto et al., 2007), there has been little research examining if and how HLEs and mother-child shared book reading might impact outcomes for this population. The purpose of the current study is to describe the HLEs of infants and toddlers with DS and to examine its relationship with early language abilities. Specifically, this study addressed the following research questions: 1) How do parents of infants and toddlers with DS characterize their HLEs and their child's engagement during shared book reading activities? 2) What is the quality of a shared book reading activity between infants and toddlers with DS and their mothers? 3) Do differences in the quality of HLEs, shared book reading, and home language environments relate to receptive vocabulary concurrently and six months later?

Methods: The current study was part of a larger project examining predictors of first words in DS using a within-group longitudinal design. Participants included infants and toddlers with DS ($n=13$ at Time 1; 69% male; $n=8$ at Time 2, 67% male) and their mothers. At study entry, children were 11-29 months ($M=17.92$ $SD=5.27$). At both time points, mothers completed the *MacArthur-Bates Communicative Development Inventories* (CDI; Fenson et al., 2007) and children were administered the *Mullen Scales of Early Learning* (MSEL; Mullen, 1995). At Time 1, mothers also completed a *Home-Literacy Environment Questionnaire* (adapted from Boudreau, 2005; Peeters, 2009) to assess richness of the HLE and their child's engagement in shared book reading and completed a shared book reading task at home while their child was wearing a *LENA Recorder DLP* (LENA Research Foundation, 2018; $n=12$ dyads completed). This activity was transcribed and coded to assess the quality of shared book reading. Adult word count, automatically calculated from the LENA, was used to represent the home language environment.

Results: RQ 1a) All mothers reported that they began reading to their child between 0-12 months of age, and half reported a designated reading time. When asked about the past week, 12 mothers reported that they read a total of 5-11+ books with their child across 3-11+ sessions. Mothers also reported they had many books in the home (children's books: $M=108.18$, $SD=91.63$; adult books: $M=107.00$, $SD=76.17$). A majority of mothers reported that during shared book reading activities they point out details from the story that are outside of the written text ($n=13$), relate story events to their child's everyday life ($n=10$), and ask questions about the story ($n=7$).

RQ 1b) When asked about their child's engagement, almost all mothers reported that their child grabs for or holds the book ($n=13$) and turns pages ($n=12$). A majority of mothers also reported that their child points to pictures or words ($n=8$). Half reported that their child asks to read books or pretends to read the story in a book.

RQ 2) During the mother-child shared book reading task, mothers used interactive reading styles, including expansions ($n=12$), questions ($n=11$), labeling ($n=10$), comments ($n=8$), and requests ($n=3$).

RQ 3) Multiple linear regression examined the contributions of richness of HLE, child engagement, quality of shared book reading, and the home language environment to child receptive vocabulary as measured by the CDI. At Time 1, the total variance explained by the model was 90%, $F(4, 7) = 15.10$, $p=.001$. Child engagement, $\beta = .85$, $t = 6.51$, $p<.001$, uniquely contributed 72% of the variance. The home language environment, $\beta = -.44$, $t = -3.42$, $p=.01$, contributed another 17%. Richness of HLE and quality of shared book reading were nonsignificant. At Time 2, with only child engagement and the HLE entered as predictors, the total variance explained by the model was 76%, $F(2, 6) = 9.64$, $p=.01$. Child engagement emerged as the strongest predictor, $\beta = .87$, $t = 4.38$, $p=.005$, uniquely contributing 76% of the variance. The HLE was nonsignificant.

Discussion: Mothers reported providing their infants and toddlers with DS rich HLEs. Results also suggest that child engagement and the home language environment (i.e., adult word count) are particularly important to receptive vocabulary development. However, in our model, increased receptive vocabulary was inversely related to adult word count. It is possible that as children gain greater understanding of words—more receptive language—parents do not talk as much because they are not providing additional linguistic mapping. For example, if a parent knows their child does not know the word ball, they may provide a lot of linguistic mapping ("Ball! You want the ball. Here is the ball!"). Once they know that their child knows the word ball they may simply say, "Here's the ball". Taken together, our results suggest that clinicians working in early intervention should teach families of infants and toddlers with DS practical ways to embed literacy-related activities into their child's everyday experiences as well as how to promote child engagement in shared book reading activities.

References/Citations:

- Abbeduto, L., Warren, S. F., & Conners, F. A. (2007). Language development in Down syndrome: From the prelinguistic period to the acquisition of literacy. *Mental Retardation and Developmental Disabilities Research Reviews*, 13(3), 247-261.
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Paper 3 of 4

Paper Title: Maternal Mental State Language Use during Shared Storybook Reading with Children who have Down Syndrome

Authors: Marie Moore Channell³

Introduction: Children with DS characteristically struggle with expressive language (McDuffie et al., 2017) and mental state language use during narrative storytelling (Channell, 2020). Mental state language—references to emotions, thoughts, intentions, etc.—is key to well-developed narratives; it communicates character perspectives, feelings, and goals. More broadly, it is critical for perspective-taking and prosocial expression of one’s feelings during social interactions. In typical development, young children’s mental state language is facilitated by maternal talk about mental states (Taumoepeau & Ruffman, 2008); this relationship is mediated by children’s emotion knowledge (understanding other people’s emotional expressions and the causes and consequences of their emotions) (Ensor & Hughes, 2008). The current study tested this theoretical model in older, school-age children with DS. The primary aim was to determine the role of maternal mental state language use in children’s emotion knowledge and mental state language development.

Method: As a part of a larger study, 33 children with DS (6-11 years old; $M = 8.66$, $SD = 1.70$) and their mothers participated. Children completed the Leiter-3 test of nonverbal IQ, the Emotion Judgement Test (EJT) of nonverbal emotion knowledge (Channell et al., 2014), and an examiner-child narrative language sampling task using a wordless picture book (Abbeduto et al., 1995; Channell et al., 2018). Mother-child dyads completed a shared storytelling task, also with a wordless picture book. Both examiner-child and mother-child narratives were recorded and later transcribed using SALT software (Miller & Iglesias, 2012). The examiner-child narrative transcripts were coded for children’s spontaneous use of mental state words (Channell, 2020). The mother-child narrative transcripts were coded for the percentage of mothers’ utterances that included any mental state references.

Results: A range of child mental state language (number of different mental state terms used = 0-14, $M = 3.91$, $SD = 3.69$) and maternal mental state language (% utterances containing mental state talk = 6.21-39.81, $M = 22.57$, $SD = 7.85$) was observed. A bootstrapping method was used to test the proposed mediational model because it is recommended for small sample sizes (Preacher & Hayes, 2008); it does not assume a normal distribution of the indirect effect and is higher powered than the traditional Sobel test (Hayes, 2019). In the current study, 5,000 iterations estimated the mediated effect. The bias corrected and accelerated 95% CI did not cross zero (.01-.16) and thus was statistically significant. The point estimate for the mediator (emotion knowledge) was 0.06 ($SE = .04$). Follow-up analyses using Baron and Kenny’s (1986) method for testing mediation yielded consistent findings (all p -values < .10). Results also suggested full mediation because the coefficient estimating the effect of maternal mental state language on child mental state language dropped significantly (from $b = .32$ to $b = .07$) and was no longer significant once child emotion knowledge was added to the model.

Discussion: Results provide preliminary evidence of concurrent mediation in which child emotion knowledge fully mediates the effect of maternal mental state language on child mental state language use in school-age children with DS. This is consistent with the literature regarding the influence of maternal language input on young typically developing children’s mental state language development. This study showed that for children with DS, the positive impact of maternal mental state language is evident in the school-age years. Mothers of school-age children with DS have reported that storybook reading with their children is a frequent activity at home (Trenholm & Mirenda, 2006; van Bysterveldt et al., 2010). Thus, it is a ripe context for increasing mother-child conversations about mental states, even into middle childhood. This study’s findings also connect to the DS phenotype—relative strengths in socio-emotional skills (e.g., emotion knowledge) and difficulties in expressive language.

Therefore, mother-child conversations about mental states could capitalize on children's strengths in emotion knowledge to enhance their mental state language development. Future planned analyses include identifying other maternal behaviors and responsive strategies that may contribute to increased talk about mental states.

References/Citations:

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Paper 4 of 4

Paper Title: A Review of Parent-Child Interaction Therapy to Promote Communication and Language Development in Children with Down Syndrome

Authors: Ciara O'Toole⁵

Introduction: Communication and language development are areas of particular weakness for young children with DS. Caregivers' interactions with children influences language development, so many early interventions involve training parents how best to respond to their children and provide appropriate language stimulation. Thus, these interventions are mediated through parents, who in turn are trained and coached in the implementation of interventions by clinicians. As the interventions involve a considerable commitment from clinicians and families, we undertook this review to synthesize the evidence of their effectiveness.

Methods: Randomized controlled trials of parent-child interaction therapy designed to improve the language and communication of children with DS aged 0-6 years were reviewed. We searched a range of psychological and education databases including CENTRAL, MEDLINE, Embase, and PsychINFO in March 2016 (updated January 2018). Reference lists of key articles were searched and field experts contacted. From this we identified 56 potentially relevant articles.

Results: After accessing and reading the full texts, three studies were identified that met the inclusion criteria. The studies used slightly different models of intervention and outcome measures, and so the results could not be combined in a meta-analysis. All of the studies were found to have a high risk of bias in relation to blinding of outcome assessors and the evidence was found to be of very low quality in terms of small sample sizes among other factors. Two studies did not find that the intervention improved general language skills, apart from words that were specifically targeted. One study did report improvements in the children's overall language and socialization. All studies reported changes in how the parents interacted with their children.

Discussion: There is currently very limited evidence to support parent-mediated interventions for promoting language in children with DS. The evidence to date suggests that intervention should be more individualized to the child's communication goals and include a higher dosage of individual sessions. Recent research from the KidTalk group at Vanderbilt University (Kaiser & Kasari, 2018) used a combination of Joint Attention Symbolic Play Emotional Regulation and Enhanced Milieu Teaching (JASPER-EMT) and was the first study to date to demonstrate an improvement in the children's language that was maintained over time. The differences between this intervention and previous interventions will be teased apart in order to hypothesize about the active ingredients of parent-child interaction therapy that may be important for children with DS.

References/Citations:

- Kaiser, A.P., and Kasari, C. (2018). *Phenotypic Specific Communication Intervention for Children with Down Syndrome* (Clinicaltrials.gov Identifier NCT02158390). Retrieved from <https://clinicaltrials.gov/ct2/show/NCT02158390>

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