Title: Relations Between Maternal Language Input and Child Language Development for Children with Williams Syndrome

Authors: Abigail L. Fischbach[1], Katarina L. Mayer[1], Angela M. Becerra[1], Carolyn B. Mervis[1]

Introduction: Maternal language input (MLI) – the language the mother uses when talking with her child – affects child language acquisition for both typically developing (TD) children (e.g. Hoff-Ginsberg, 1986) and children with developmental disabilities such as autism spectrum disorder (e.g., Bang & Nadig, 2015) and Down syndrome (e.g., Zampini et al., 2012). In the present study, we provide the first examination of the relation of MLI to the early language acquisition of children with Williams syndrome (WS), a rare genetic disorder associated with language delay and intellectual disability. The aim of the present study was two-fold: To examine concurrent relations between MLI and child language abilities at 24 months and to determine if individual differences in MLI and children's lexical and cognitive abilities at 24 months make significant unique contributions to the variance in child language abilities at 48 months for children with WS.

Method: Participants were 34 children with genetically confirmed classic deletions of the WS region (16 girls, 18 boys) and their mothers. Children's language and cognitive abilities were assessed with the Mullen Scales of Early Learning (MSEL; Mullen, 1995) at ages 24 and 48 months. Mothers completed the MacArthur-Bates Communicative Development Inventories: Words & Sentences (CDI, Fenson et al., 2007) to determine child expressive vocabulary size (CDI-EV) at 24 and 48 months and grammatical complexity (CDI-SC) at 48 months and whether or not the child was producing spontaneous word combinations at 24 months. Mother-child dyads participated in a 30-minute play session when the child was 24 and 48 months old. From these play sessions, child lexical diversity (number of different words - cNDW) and grammatical ability (mean length of utterance in morphemes - cMLUm) were determined at 24 and 48 months. MLI was characterized from the 24-month play session by maternal lexical diversity (mNDW) and grammatical complexity (mMLUm).

Results: At 24 months, mean CDI-EV was 40.71 words (SD = 43.28, range: 0 – 236), mean cNDW was 10.06 words (SD = 13.80, range: 0 – 58), and mean cMLUm was 0.88 (SD = 0.42, range: 0 – 1.33). Only six children (17.6%) were reported to be producing spontaneous word combinations. Mean mNDW was 228.14 words (SD = 59.87, range: 118 - 338) and mean mMLUm was 3.08 (SD = 0.50, range: 2.24 – 4.14). At 48 months, mean CDI-EV was 459.00 words (SD = 159.70, range: 65 – 679), mean CDI-SC was 18.82 (SD = 13.90, range: 0 – 37), mean cNDW was 109.53 (SD = 51.16, range: 25 – 201), and mean cMLUm was 2.50 (SD = 0.74, range: 1.00 – 4.00). Significant concurrent correlations were found between maternal lexical diversity (mNDW) and child lexical ability: CDI-EV ($r = .47$, $p = .005$) and cNDW ($r = .51$, $p = .002$) at 24 months. No significant concurrent correlations between maternal grammatical complexity and child language abilities at 24 months were found.

To determine the contributions of mNDW, child CDI-EV, and child nonverbal reasoning ability (MSEL Visual Reception T score) at 24 months to child lexical ability and overall language ability at 48 months, four multiple regression analyses were conducted. Each of the analyses accounted for a significant amount of variance in the dependent variable. For cNDW, $F(3,30) = 12.33$, $p < .001$, $R^2_{adj} = .51$; nonverbal reasoning ($p = .004$) was the only significant contributor. For CDI-EV, $F(3,30) = 15.48$, $p < .001$, $R^2_{adj} = .57$; both nonverbal reasoning ($p = .008$) and CDI-EV ($p = .018$) made significant independent contributions. For MSEL Receptive Language T score, $F(3,20) = 33.11$, $p < .001$, $R^2_{adj} = .75$; all three predictors contributed significantly to the model. For MSEL Expressive Language T score, $F(3,30) = 22.53$, $p < .001$, $R^2_{adj} = .66$; nonverbal reasoning ($p < .001$) and CDI-EV ($p = .031$) contributed significant unique variance to the model.

To determine the contributions of mMLUm at the 24-month play session, child CDI-EV at 24 months, and child nonverbal reasoning ability at 24 months to child grammatical ability and overall language ability at 48 months, four additional multiple regression analyses were conducted. For cMLUm, $F(3,30) = 15.85$, $p < .001$, $R^2_{adj} = .57$: each of the three predictors significantly contributed significant unique variance. For CDI-SC, $F(3,30) = 12.83$, $p < .001$, $R^2_{adj} = .52$; nonverbal reasoning ($p = .009$) and CDI-EV ($p = .022$) contributed significant unique variance. For MSEL Receptive Language T score, $F(3,20) = 35.08$, $p < .001$, $R^2_{adj} = .76$; all three predictors contributed significant unique variance. For MSEL Expressive Language T score, $F(3,30) = 22.73$, $p < .001$, $R^2_{adj} = .66$; nonverbal reasoning ($p < .001$) and CDI-EV ($p = .017$) significantly contributed to the model .

Discussion: These findings are consistent with previous findings for TD children regarding the relation between concurrent maternal lexical diversity and child lexical ability. However, the only 48-month child language measure for which maternal lexical diversity at 24 months was a significant predictor after taking into account the contributions of child vocabulary size and nonverbal reasoning ability at 24 months was MSEL Receptive Language T-score. Although no significant concurrent correlations were found between maternal grammatical complexity and child language abilities at 24 months, maternal grammatical complexity significantly accounted for unique variance in both 48-month MSEL Receptive Language T-score and 48-month child MLUm even after taking into account child vocabulary size and nonverbal reasoning ability at 24 months. Theoretical and practical implications will be discussed.

References: Bang, J. & Nadig, A. (2015). Learning language in autism: Maternal linguistic input contributes to later vocabulary. *Autism Research*, *8*, 214–223

Fenson, L., Marchman, V.A., Thal, D.J., Dale, P.S., Reznick, J.S. & Bates, E. (2007). *MacArthur-Bates Communicative Development Inventories: User's guide and technical manual* (2nd ed.). Baltimore, MD: Brookes

Fusaroli, R., Weed, E., Fein, D. & Naigles, L. (2019). Hearing me hearing you: Reciprocal effects between child and parent language in autism and typical development. *Cognition*, *183*, 1–18

Hoff-Ginsberg, E. (1986). Function and structure in maternal speech: Their relation to the child's development of syntax. *Developmental Psychology*, *22*, 155–163

Mullen, E.M. (1995). *Mullen Scales of Early Learning*. Circle Pines, MN: American Guidance Service

Zampini, L., Fasolo, M. & D'Odorico, L. (2011). Characteristics of maternal input to children with Down syndrome: A comparison with vocabulary size and chronological age-matched groups. *First Language*, *32*, 324–342

[1]University of Louisville