Investigating Language Acquisition Between Children at Low vs. High-Risk of Autism: Parent's Labeling and Description Use During Parent-Child Interactions

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Evidence shows parents enhance their child's word learning abilities by providing labels and descriptions of novel objects, an approach that has been applied in interventions for parents of children with attentional difficulties and developmental disabilities to encourage simplified language input and increase the child's attention during interactions. Using parent-child transcripts from the CHILDES database, this project investigates whether there are any differences in labeling and description use between typical and at-risk infants. This study uses data from Quigley and McNally's (2013) study involving 10 typically developing infants with no known developmental risk factors and no family history of autism and nine at-risk infants who had an older sibling diagnosed with autism. We found when mothers' total number of utterances (i.e., how talkative the mother was) were controlled, labeling between groups was trending towards significantly different ($p = 0.053$) with mothers in the high-risk group providing less labels than mothers in the low-risk group. Additionally, a significant difference was found in how parents used descriptions with mothers in the high-risk group providing less descriptions compared to mothers in the low-risk group ($p = 0.005$). These results show that parents of children at high-risk of developing autism adjusted their communicative frame to fit their children's needs, specifically by providing fewer complex sentences to create a simplistic way of introducing and describing new words to their child's environment. .

Keywords: Language development, developmental disorders, labeling, description use, parent-child interactions

Introduction

Prior research has found that parents tailor their speech and interactions to facilitate their child's early word learning (Adamson et al., 2015) such as how they label and describe objects (LaTourrette & Waxman, 2019; Booth, 2015). However, parents of children with developmental disabilities may communicate with their child differently due to attentional difficulties (Mohan et al., 2022). Studies have shown that parents of children with ASD, for example, adjust their communicative frame to increase their child's attention (Adamson et al., 2001, 2015). Yet, how parents of children with developmental disabilities adjust their utilization of language inputs during parent-child interaction remains underexplored, particularly in terms of specific strategies such as labeling and description use. Therefore, the current study examined whether there are differences in labeling and describing objects during parent-child interactions, specifically between parents of typically developing children and parents of children at risk of developing Autism Spectrum Disorder (ASD). This investigation can help clarify how parents support language development differently depending on their child's developmental profile.

Definitions, Examples, and Differences

Providing descriptions is a method in which parents facilitate children's early word learning. Descriptions can be composed of simple properties (e.g., body shape, prototypical color) of an object (Saylor et al., 2016) or complex properties like causal properties (e.g., function of an object; Booth, 2009; Booth, 2015). For instance, when describing a dog, a parent might say, "This dog has a long tail," which is a non-causal description because it simply notes observable features about the dog. In contrast, saying, "This dog wags its long tail to show it's happy," is a causal description, as it explains the function or reason behind the dog's behavior: to show it's happy. Both types of description are valuable for children's language acquisition, but causal descriptions

have been found to possess a facilitative effect on language acquisition due to its ability to enhance and attract attention during interaction (Booth, 2015). This finding is further supported by research showing young children attending more to causal than non-causal events (Mascalzoni et al., 2013). Beyond what a parent says, these findings emphasize the critical role of verbal input structure in facilitating children's language acquisition. These studies primarily involve typically developing children, however, so it remains less clear whether parent-child interactions involving children with developmental disorders follow similar patterns.

Attention and Language Acquisition

The effectiveness of providing descriptions in language learning depends, in part, on children's attentional processes, making attention a useful bridge to understanding broader mechanisms of word acquisition. Specifically, attention is important for children's language acquisition because children must attend to what is being said and what is being labeled to acquire the word. McDuffie et al. (2006) found a relationship between labeling and attention; specifically, that listening to verbal labels increased visual attention in typically developing toddlers. Particularly, joint attention, the coordinated attention between two people and an entity of interest (Carpenter et al., 1998), serves as a mediating factor between parent-child interaction and language acquisition. For example, a parent might make a link between a novel word (i.e., label) to the child such as "bell" and its referent (i.e., the actual bell visible to the child) more transparent by calling attention to an object such as shaking the bell. By successfully following the parents' cues utilized to call attention to the referent, children become more efficient with their word learning (McDuffie et al., 2006). Therefore, parents can support this process by either introducing a new word into the child's ongoing stream of attention or following the child's lead when producing labels (Adamson et al., 2015). This results in parents adapting a more effective approach based on their children's attention when including language inputs during parent-child interactions (Dunham et al., 1993; Brigham et al., 2010), further proving how the underlying mechanism of attention serves as a bridge between parental input and their child's word learning.

However, less is known about how variations in children's attentional capacities, such as those linked to developmental disorders, might influence parents' interaction strategies. Prior research has alluded to potential differences in communication strategies between parents of typically developing children and those with developmental disorders (Mohan et al., 2022), further reflecting how linguistic adjustments showcase parents' efforts to adapt to their children's responsiveness and engagement. For example, parents of children with ASD were found to have used a comparatively lower number of nouns, verbs, conjunctions and case markers compared to parents of typically developing children (Mohan et al., 2022). Therefore, understanding these nuances could reveal important differences in how parents of children with developmental disorders may adapt specific communication strategies to their child's developmental needs.

ASD and Language Acquisition

Given the importance of attention in early word learning, it is important to understand how this mechanism functions for children with developmental disabilities compared to typically developing children and how it may shape parent-child communication strategies. For example, children with ASD have early communication problems that contribute to difficulties in early language acquisition (Eigsti et al., 2011; Vogindroukas et al., 2022). One cause may be due to their attentional deficits, such as difficulties in joint attention skills which involve initiating and responding to bids for shared attention—gestures or behaviors used to direct another person's focus to an object or event (Meindl & Cannella-Malone, 2011). Due to these attentional difficulties, children with ASD have limited interest and attention to new objects, limiting parents' opportunities to engage the child long enough to present any language input and introduce novel words (Adamson et al., 2010). This highlights how early impairments in attention can create a foundational barrier to language learning for children with ASD, urging parents to alter their language inputs in response to their child's unique attentional needs. Studies have shown parents' adaptations in their communicative frame during interactions such as how parents of children with ASD make objects more perceptually salient or repeat the word (i.e., label) more often as they bid for joint attention (Adamson et al., 2001; 2015), promoting young children's efficiency in learning new words (Schwab & Lew-Williams, 2016). Therefore, when parents repeat novel words, they are better able to capture their child's attention and facilitate their early word learning. These findings suggest that although children with ASD may experience attentional difficulties, parents' adaptation of their language inputs can play a compensatory role in supporting their children's language acquisition.

Despite the positive effect that labeling and description use have on language learning in typically developing populations (LaTourrette & Waxman, 2019; Booth, 2015), there is inconclusive evidence within the atypical population in relation to the associations between attention and language inputs. In one study, two-year-olds diagnosed with ASD were compared with comprehension-matched, typical children. Results indicated that attention to a novel object increased with labeling in the atypical group (McDuffie et al., 2006). This suggests that labeling can sometimes enhance attentional engagement in children with ASD. In contrast, when comparing preschoolers with typical development, Williams syndrome, and ASD, verbal labels did not increase attention to unfamiliar objects for the autism group as opposed to their counterparts (Vivanti et al., 2016). Additionally,

Hani et al. (2013) found no significant differences in parents' labeling between children with ASD and typically developing children. These results reveal that the effect of verbal labels on attention may not be consistent across different studies or developmental profiles. Therefore, these mixed findings underscore the need for more research on how parents use verbal labels and how adjusting their labeling during parent-child interactions affect the responsiveness and attentional engagement of children with ASD. Moreover, while some research has examined the use of verbal labels, no literature to date has directly investigated the role of description use (e.g., causal vs. non-causal) in parent-child interactions and its relationship with language acquisition for children with developmental disorders. Given this gap, further research is warranted to explore how both labeling and description use are used by parents of children with ASD—and how these strategies may support early language development. Understanding these patterns can shed light on the nuances of parent-child interactions and how parents of typically developing children and atypical children could differ in their language inputs during parent-child interactions.

Current Study

It is unclear whether parents of children with a high-risk for ASD adapt their use of language inputs differently from parents of low-risk children. Therefore, the current study aimed to address this gap by examining mother-child interactions of low-risk and high-risk children. Using transcripts from the CHILDES database, we asked 1) do mothers of infants with a high risk of developing ASD label and describe referents more often during parent-child interactions than mothers of infants with low risk? and 2) does infants' risk of developing autism predict how often their mothers label and describe referents during parent-child interactions? Our first question aimed to explore differences in labeling and description use between mothers of high-risk and low-risk infants, shedding light on how risk profiles may shape parent-child communication. We expected that mothers in the high-risk group label and describe referents more often during their interactions with their infants as opposed to mothers in the low-risk group based on prior research on how labeling and repetition support attention and consequently language acquisition for children with ASD (Adamson, 2015; McDuffie et al., 2006).

Our second research question delves deeper on these differences by investigating whether a child's risk of developing ASD predicts the frequency of these language inputs, providing insight into how parents may adapt their communication strategies to their child's developmental needs. We expect risk profile (high-risk and low-risk) to predict how often mothers provide labels and descriptions of referents during their interactions with their infants.

Together, both questions offer a comprehensive understanding of how risk profile influences parental language input, both at the group level and in terms of individual variations, enriching our knowledge about parents' communicative strategies during parent-child interactions. Furthermore, by investigating the influence of heightened risk for developing autism on parental language input, we can build solid foundational evidence that informs future research to compare low-risk infants (or typically developing) to those officially diagnosed with autism. This approach helps in highlighting early communicative differences that may be present before an official diagnosis, inspiring practitioners to develop timely interventions that can benefit children's language development.

Method

Corpus and Participants

Participants were 10 typically developing infants (three girls and seven boys; low-risk group) with no known developmental risk factors and no family history of ASD and nine infants at risk of autism (seven girls and two boys) which includes two infant identical twin girls. The original researchers included the identical twins to validate their observational method. They found the mother's language behavior to be consistent across both of her twin infants, suggesting that the testing condition elicited natural interactions reflective of her typical speech style. The high-risk group (HR) was defined as having a higher genetic risk of developing autism due to having an older sibling(s) diagnosed with ASD. One child in the low-risk group (LR) and three children of the HR group have subsequently received a diagnosis of ASD after three years.

The transcripts used in this study are parent-child interactions from Quigley and McNally's (2013) longitudinal study in the Child Language Data Exchange System database (CHILDES; MacWhinney, 2000). These transcripts were specifically chosen as they were the most recent study that included a control group (i.e., typically developing infants), allowing us to compare differences between the mother-infant interactions between a low-risk and high-risk group. Mother-infant dyads and their interactions were filmed once every four weeks mostly in their homes but occasionally in a free-play room at a developmental lab at the university. To obtain semi-naturalistic behavioral information, the mothers were asked to interact with their infants as they naturally would, and the experimenters did not provide any toys or props. Filming occurred between the ages of three and 12 months for each infant with an average of seven to eight visits total for each parent-child dyad.

Each visit was filmed for 15 minutes. However, the first three minutes of the recording was not used for analyses due to the families still adjusting to the filming set-up and mothers and infants were beginning to establish their interaction. After this three-minute period, the next continuous five minutes of interaction where the infants were not fussing or crying were

transcribed using the CHAT system (MacWhinney, 2000) and uploaded to CHILDES. A total of 203 transcripts were available from the corpus and analyzed in the current study.

Coding Procedure

Each participant was assigned a participant ID number, and each transcript was assigned a visit number (one to 203). Transcripts were randomly assigned to coders who were trained with a coding manual (Appendix A) that specified both the annotation procedure and exclusion criteria.

First, we reviewed the transcripts and implemented an exclusion criteria. The exclusion criteria ensured coding focused on meaningful and contextually relevant instances of labeling and description use that were aimed to teach a new word to the child. Utterances involving the child's name or shortened name, or other people's names were excluded, as these do not contribute descriptive or referential information essential for assessing language inputs aimed to teach the infant new words. Similarly, nicknames (e.g., "sweetie") and phrases used as nicknames (e.g., "little sleepyhead," "creepy boy") were omitted, as they lack descriptive specificity about objects or events in the child's environment. Common phrases such as "good girl" or "good job" were also excluded because they primarily function as evaluative or reinforcing statements rather than labels or descriptions. Finally, utterances that included the mothers' singing were not coded but highlighted for potential future directions, as singing often involves scripted or repetitive language that may not reflect the parent's intentional use of language to support the child's learning. Then, coders went line-by-line through the transcripts to indicate the presence of parents' labeling occurrences and description use. If labeling or description use was present, coders identified the label in the utterance or identified the type (i.e., causal or non-causal) of description using the guidelines on the coding manual.

Labels

Coders marked the presence of a label if a parent talked about the proper name of an object or any physical being in an utterance. Labels did not need to be present in the current environment of the mother and child during the interaction. This can range from toys the mother referred to during play (e.g., ball) to a child's body part (e.g., nose), or an object that the mother would refer to from a past event.

Description Use (Casual)

Coders marked any causal description used in the utterances and labeled "CAUSAL" within the description use column. These were descriptions that added effective powers to an object, such as conceptual properties of the referent or functional information about the referent (Booth, 2009; 2015). Additionally, based on past research involving causal adverbials and their positive effects in learning, examples can also include sentences. Causal description utterances could also contain an "if-then" statement or a "because" statement based on prior research showing that causal adverbials have positive effects on learning (e.g., "And why was she called Goldilocks? Because she had beautiful hair;" Curran & Van Horne, 2019).

Description Use (Non- Casual)

Coders marked any non-causal description used in the utterances that added value to the label presented by the parent and provided additional perceptual and non-conceptual information about the referent (Booth, 2009). These descriptions were typically one-word and could range from different classes such as color, size, pattern, etc., or any adjectives the parent used to describe a noun's perceivable features in the utterance. Typically, non-causal descriptions can occur more than once in a single utterance, so coders were instructed to note all instances of non-causal descriptors.

Reliability Procedure

Each coder was randomly assigned one-third of the 203 transcripts to code. To assess reliability, all 203 transcripts were coded in its entirety by a second coder. A random sample of 46 transcripts were selected for the reliability analysis. Reliability was excellent (Krippendorff, 2004; $M_{alpha} = 0.97$, range = 0.91-1.0). Disagreements were resolved through discussion between the primary and secondary coders and included in the final dataset for analysis.

Data Analysis Plan and Statistical Analyses

To address our research questions, we employed both independent samples t-test and linear regression analyses. The t-tests were used to examine whether there were significant differences between mothers of HR and LR infants in their proportion of labeling and description use during interactions. These tests allowed assessment of group-level differences across different types of parental language input. To further examine whether ASD risk predicted maternal language input, we conducted linear regression analyses with risk status as the predictor variable. In these models, the HR group was dummy coded as the reference category (0), while the LR group was coded as 1. The outcome variables included the frequencies of labels and descriptions used during the interaction.

Labeling Analysis

The current study examined the frequency and proportion of labeling between the HR and LR groups and the differences between these groups. The proportion of labeling was defined as the total number of utterances where labeling occurred divided by the total number of utterances of each mother-child dyad for all their respective sessions. This accounted for how talkative the mother (i.e., total number of utterances) was during the interaction. Lastly, frequencies of labeling were calculated based on the total labels that the mothers stated throughout the sessions for each participant.

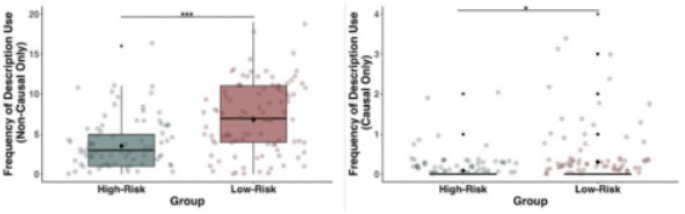
Description Use Analysis

The current study examined the frequency and proportion of description use between the HR and LR groups for all types of description use. We analyzed parents' description use for the following categories: causal only, non-causal only, and both together. The proportion of description use for all three analyses were defined as the total number of utterances where description use occurred (non-causal and/or causal) divided by the total number of utterances of each mother-child dyad for all their respective sessions, again accounting for how talkative the mother was throughout the study. Lastly, frequencies of description use were calculated based on the total descriptions, for each type, the mothers stated throughout the sessions for each participant.

Results

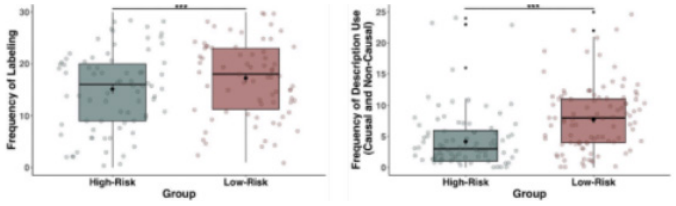
Frequency of Labeling Labeling Analysis

We first asked if there was a difference in the frequency of labeling between mothers of low-risk children and high-risk children. The proportion of labeling was higher for the LR group (M_{LR}=0.30, SD_{LR} = 0.12) compared to the HR group, (M_{HR}=0.22, SD_{HR} = 0.05). This difference was closely significant as indicated by an independent sample t-test, $t(17) = -2.08$, $p = .053$, d = -0.95). These results are shown in Figure 1A.



Frequency of Description Use

We next asked if there was a difference in the frequency of description use between mothers of low-risk children and high-risk children. The proportion of general description use was significantly higher for the LR group (M_{LR} = 0.10, SD_{LR} = 0.04) than the HR group (M_{HR} = 0.05, SD_{HR} = 0.03) as indicated by an independent samples t-test, $t(17) = -3.19$, $p = .005$, d = -1.47. This result suggests a large effect size, indicating a substantial difference in general description use between groups. These results are shown in Figure 1B. For the non-causal description use only, the proportion was also higher in the LR group (M_{LR} = 0.08, , SD_{LR} = 0.03) than in the HR group (M_{HR} = 0.04, SD_{HR} = 0.02), $t(17) = -3.26$, $p = .03$, d = -1.50, which also suggests a large effect size. A similar significant difference and a large effect size were found with the causal description use only category, $t(17) = -2.33$, $p = .03$, d = -1.07, with the LR group (M_{LR} = 0.003, SD_{LR} = 0.003) having a higher mean proportion of causal description than the HR group (M_{HR} = 0.001, SD_{HR} = 0.001). These results are shown in Figure 2A and 2B. Overall, we found that mothers of low-risk children used more labels and more descriptions compared to mothers of high-risk children with all differences associated with large effect sizes.



Effect of Risk Profile on Labeling and Descripton Use

Our second research question asked if group membership (HR vs. LR) predicted the frequency of labeling and description use. To assess the effect of risk profile on the frequency of labeling, a linear regression with risk profile as the predictor variable and frequency of labeling as the outcome variable was run. The regression model was significant, $F(1, 200) = 11.23$, $p < .001$, explaining approximately 5.32% of the variance in labeling frequency ($R^2 = 0.053$). Group membership significantly predicted labeling frequency (B = 7.67, SE = 2.29, $t = 3.35$, $p < .001$), with the LR group showing higher frequencies of labeling compared to the HR group. The intercept (B = 19.05, SE = 1.67) reflects the average labeling frequency in the HR group. These results are shown in Table 1.

Predictor	*Estimate*	*SE B*	*t-value*	*p*	R^2
Intercept	19.053	1.674	11.385	< .001	0.053
Group	7.669	2.289	3.351	< .001	0.084

In addition, a separate linear regression analysis was performed to assess the relationship between group membership and description use, including both causal and non-causal descriptions. As for general description use (causal and non-causal), the model linear regression model was also significant, $F(1, 200) = 18.30$, $p < .001$, explaining approximately 8.38% of the variance in general description use frequency ($R^2 = 0.084$).
Group membership significantly predicted description use (B = 4.02, SE = 0.94, $t = 4.28$, $p < .001$), with the LR group exhibiting

Table 2 *Regression Coefficients for General Description Use (Causal and Non-Causal) by Group*

Predictor	*Estimate*	*SE B*	*t-value*	*p*	R^2
Intercept	4.723	0.687	6.878	< .001	0.033
Group	4.017	0.939	4.278	< .001	0.080

Table 3 *Regression Coefficients for Non-Causal Only Description Use by Group*

Predictor	*Estimate*	*SE B*	*t-value*	*p*	R^2
Intercept	4.638	0.664	6.983	< .001	0.033
Group	3.797	0.908	4.180	< .001	0.080

Table 4 *Regression Coefficients for Causal Only Description*

Predictor	*Estimate*	*SE B*	*t-value*	*p*	R^2
Intercept	0.085	0.062	1.373	0.171	0.053
Group	0.220	0.085	2.600	< .05	0.084

Note. Results are based on linear regression models with group (HR vs. LR) as the predictor variable and mothers' language input as the outcome variables. R^2 represents the proportion of variance explained by the model. SE B = Standard Error of B.

Discussion

We used two different methods of analysis to investigate whether there are differences in how often mothers labelled and described referents to their children and whether risk can predict their labeling and description use behavior. Our results showcased close to significant differences in the mothers' labeling and significant differences in their description use for all categories between the HR and LR groups. Furthermore, we found that developmental risk predicted how much mothers labeled and described referents during their interactions. The effect sizes for these group differences were also large (Cohen's d > 0.8), indicating that the observed differences were not only significant but also practically meaningful in real-world settings. This suggests that the frequency in which mothers provided labels and descriptions of referents—more particularly so with their descriptive language—substantially differs depending on the child's ASD risk status, with likely implications for language learning opportunities during early development. These findings, therefore, can drive meaningful and effective interventions that aim to prioritize specific language inputs that are more effective in facilitating early word learning such as increasing descriptive language during interactions for children with a high-risk of developing ASD.

Impact of ASD Risk Status on Mothers' Language Inputs

Our findings show that there are differences in mothers' labeling and description use between the HR and LR group. The regression analysis supported our second hypothesis: infant ASD risk status significantly predicted maternal language input during interaction. However, these results disproved our first hypothesis: labeling and description use differences showed mothers in the HR group labeled and described referents less often compared to those in the LR group, as opposed to an opposite trend.

An explanation for these results can be due to the infants' attentional focus during the interactions. More specifically, the infants' high-risk might have caused the mothers to adjust their communicative behavior based on their child's attentional engagement. As discussed by Adamson et al. (2015), parents of children at higher risk for developmental disorders may modify their language input to better suit their child's ability to engage and attend. This could explain why ASD risk influenced the amount of times mothers were labeling and describing referents during interactions, resulting in mothers in the HR group being more selective or strategic in offering information about referents during their interactions—depending on their child's engagement—compared to mothers in the LR group. Additionally, children with ASD have limited interest and attention to new objects (Adamson et al., 2010). This attention deficit further affects parents' language input when introducing and presenting novel words (Mundy, 2018), such that parents possess limited opportunities to engage the child long enough to present their language inputs during the interaction. Therefore, the limited joint attention and responsiveness during parent-child

communicative strategies, further demonstrating a possible bidirectional relationship between both concepts. These complex associations between factors like developmental risk, associated skill deficits and challenges, and language development can inspire practitioners in terms of how to better support children that are not only officially diagnosed with ASD, but also those that are at-risk of developing ASD. Future interventions related to improving the language development of populations that have deficits in their communicative skills such as children with ASD can focus on which factor to enhance on, such as children's attention or their parents' communicative strategies, in hopes to effectively support children's early word learning. For example, practitioners could support parents in using non-verbal strategies (e.g., gesture, eye gaze, and showing) to scaffold attention and enhance word learning for at-risk infants. Thus, our findings not only confirm that maternal input varies by ASD risk group, but also underscore the importance of understanding these early adaptations as part of the broader efforts to optimize language development in high-risk populations

Labeling Trends and the Need for Multimodal Perspectives

However, it is important to note that the differences in labeling between the HR and LR groups were only approaching significance ($p = 0.053$), suggesting slight differences that warrant attention. This close to significant result may be attributed to limitations in statistical power (Cohen, 1992), possibly due to this study's small sample size of 19 participants (10 in the LR group and 9 in the HR group), limiting the ability to detect significant differences for labeling. Additionally, the unequal distribution of boys and girls between groups and the use of five-minute interaction segments may have contributed to variability and reduced the sensitivity of the test (Field, 2018; Bakeman & Gottman, 1997). These factors suggest that the trend towards significance found for labeling could be due to insufficient statistical power rather than a true absence of group differences. Therefore, taking these points into account limits the generalizability of our findings and raises the possibility that some effects—particularly for labeling—may be underpowered compared to the other language inputs examined in this study. This limitation not only affects statistical significance but also the confidence with which we can apply these findings to the broader population of mothers with and without a heightened likelihood of having an autistic child. Future studies should aim to replicate these results in larger and more diverse samples.

Beyond the statistical limits of our sample, the trend toward significance in mothers' labeling suggests that, unlike with descriptions, group differences in labeling may be more subtle or context-dependent. This finding on labeling aligns with prior research by Hani et al. (2013), which found no significant differences in parents' verbal labeling between children with ASD and typically developing children. Although our study showed a trend towards a significant difference rather than a clear absence of difference and used a younger sample of at-risk infants, these results suggest that verbal labeling alone may not fully capture group-level variation in parental language inputs. Therefore, an important implication of this study is that future research should consider not only verbal language input during parent-child interactions, but also multimodal and non-verbal communication strategies used by parents to label referents during parent-child interactions.. For example, non-verbal cues such as non-verbal labeling (e.g., pointing and showing) could have played an important role in introducing a novel word and improving attention within this sample (Brigham et al., 2010) while still representing another form of labeling. This is also supported by Hani et al. (2013)'s study, which showcased that parents of children with ASD significantly produced more shows (e.g., non-verbal cues) in combination with a verbal label compared to parents of typical children. Therefore, given the close to significant differences in our labeling findings, further caution is needed in drawing strong conclusions regarding the relationship between mothers' labeling and children's risk profiles in this sample. An adaptation of a more comprehensive parental labeling beyond just a verbal communicative strategy can expand and create a more nuanced outlook on specific differences between parents' labeling that aims to enhance their children's early word learning. Nonetheless, these findings advocate for a broader view of parental communicative behaviors beyond solely typical children, providing an additional perspective on parents' communicative frame for atypical populations.

Limitations and Future Directions

While this study provides valuable insights into the language inputs of mothers with high-risk infants, there are important limitations that should be considered when interpreting the findings and guiding future research. It is important to note that the participants in this study involved "at-risk" infants for developing autism, as they had an older sibling with an ASD diagnosis. For ASD, reliable diagnoses become available at around three years of age (Vattuone, 2021). However, studies have shown that being a "high risk" does not necessarily lead to a later ASD diagnosis. For instance, Choi et al. (2020) found that out of 55 high-risk infants, only 21 later met the criteria for ASD. Additionally, in our study, one child in the LR group and three children in the HR group later received an ASD diagnosis after age three. This provides important context when interpreting our findings, as it suggests that even within the "at-risk" designation, there may be early behavioral symptoms in children who later receive a diagnosis and those that do not. It would be valuable for future research to explore whether the significant group-level findings in this study were primarily driven by the subset of children who later received a diagnosis. This could provide a more nuanced

understanding of how early parental language strategies are shaped by subtle cues associated with later ASD outcomes.

Furthermore, the inclusion of "at-risk" infants limits the generalizability of the findings, given they had an older sibling with an official diagnosis which can, in turn, affect how the mothers interacted with these infants. Future research could explore how parents interact with both their older, autistic child and high-risk infant, examining whether the communicative strategies used with the older child are adapted when interacting with the younger, high-risk infant. It is possible that the language inputs the mothers use may be similar for both children, reflecting a generalization of the mothers' speech rather than a direct influence of the younger child's risk profile

Lastly, the regression models used to test our second hypothesis showed very low R^2 values (ranging from 0.033 to 0.084), suggesting that risk status explained only a small proportion of the variance in parental language input. This indicates that additional variables—potentially including factors such as maternal education, socioeconomic status, or children's knowledge of the words presented during the interaction—likely play important roles in shaping parental communicative behaviors. As our current study did not include these confounding variables in our analysis, future studies should aim to include and control for such factors in their models to offer a more comprehensive understanding of what drives the variation in parents' language input between atypical and typical groups. As such, future research can then make a conclusion on whether parents' adaptation of their communicative strategies, such as how often they label or describe referents, does indeed improve or perhaps worsen their children's vocabulary development.

Despite these limitations, the findings from this study also carry practical implications, particularly for early intervention. Our results suggest that infants' attention and engagement may play a key role in shaping how and when mothers provide language input. Interventions aimed at enhancing children's attentional capacities could therefore help parents make more frequent and effective use of labeling and descriptive language. Supporting mothers—particularly those of high-risk infants—with strategies to maintain engagement may in turn promote language development and mitigate communication delays. Past studies demonstrated such intervention methods that can increase the child's attention during the interaction, such as encouraging eye contact, sitting close to the child, developing play routines, and etc. (Paparella & Freeman, 2015). Implementing these strategies and training parents on the importance of utilizing these methods may help them engage their child long enough to present labels and descriptions which in turn can improve their child's language development.

Conclusion

This study investigated how mothers of high-risk (HR) and low-risk (LR) infants differ in their labeling and description use during parent-child interactions. Our findings highlighted significant differences in the use of descriptions between both groups, supporting the idea that mothers of HR infants adjust their communicative behaviors to engage their children. However, labeling differences were only approaching significance, suggesting potential limitations related to sample size and statistical power. Importantly, we found that developmental risk predicts the frequency of labeling and description use, emphasizing that challenges related to the infants' risk profiles such as attention and engagement could play a crucial role in shaping parents' communicative strategies during parent-child interactions. These results underscore the need for future research to incorporate larger, more diverse samples and to explore additional factors, such as attention and other forms of communicative strategies (e.g., non-verbal labeling), that could influence parent-child interaction dynamics. Practical implications of this study suggest that early intervention strategies focusing on enhancing children's attention and engagement may provide parents with more opportunities to use effective language inputs, ultimately supporting language development in high-risk populations.

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