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Social-emotional and Behavioral Problems in Toddlers with Language Delay

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Abstract

Purpose: Toddlers with language delay are at risk for persistent developmental and behavioral difficulties. However, the association between social-emotional/behavior problems and language in young children is not well understood. This study explored social-emotional/behavior problems in a unique sample of toddlers with language delays using a measure developed explicitly for this age group.

Methods: Toddlers identified by 18 months with receptive and expressive language delay (LD; n=30) or typical development (TD; n=61) were evaluated at 18 and 24 months of age using the Infant-Toddler Social and Emotional Assessment (ITSEA) and the Mullen Scales of Early Learning.

Results: Compared to TD, toddlers with LD had significantly more concerning scores at 18 and 24 months on all ITSEA domains. The rate of “clinical concern” on most domains was not high in either group, except that >60% of LD toddlers were in the clinical concern range on the Competence domain. Social-emotional/behavioral problems were dimensionally related to receptive and expressive language, with greater language delay associated with more concerning ITSEA scores.

Conclusions: Social-emotional and behavioral problems are related to receptive and expressive language abilities in 18- and 24-month-olds, indicating the need for screening of both types of concerns in toddlers identified with potential language delays.

Keywords

language delay; social emotional and behavioral problems; toddlers

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Introduction

The outcomes of children with language delay are variable, with early delays in language associated with increased risk for persistent language problems, learning disability and poor academic achievement, and disorders such as attention-deficit/hyperactivity disorder and autism spectrum disorder (Beitchman, Hood, Rochon, & Peterson, 1989; Beitchman, Nair, Clegg, Ferguson, & Patel, 1986; Dworzynski et al., 2007; Hawa & Spanoudis, 2014). For many toddlers, a persistent language delay may also be a risk factor for poor social competence (Horwitz et al., 2003) and increased social-emotional and/or behavioral problems (Henrichs et al., 2013). Reports indicate that approximately half of children in speech-language clinics or classrooms for children with language problems have an associated behavioral or emotional disorder (Cohen, 2001).

While research has examined the relation between early language delays and social-emotional competence/behavioral problems in preschool and school-age children (Bretherton et al., 2014), limited data exist on children younger than 3 years. Further, these data do not address the extent early social-emotional and/or behavior problems relate to significant early language delays. While studies show that some very young children exhibit problem behaviors and/or aberrancies in their nascent social-emotional skills (Baillargeon et al., 2007; Briggs-Gowan, Carter, Skuban, & Horwitz, 2001), not all studies report whether these same children have other developmental problems (Briggs-Gowan et al., 2001).

Toddlers with language delays have been found to have more behavior problems and reduced social-emotional competency compared to children without language delays both in a population-based study and in studies of clinic samples (Carson, Klee, Perry, Muskina, & Donaghy, 1998; Henrichs et al., 2013; Horwitz et al., 2003; Irwin, Carter, & Briggs-Gowan, 2002). However, research suggests that the presence and persistence of social-emotional or behavioral problems may depend on the type or degree of language delay, such that young children with more severe or pervasive language delays may show greater (Rescorla, Ross, & McClure, 2007) and potentially more persistent (Whitehouse, Robinson, & Zubrick, 2011) social-emotional problems than children with only an expressive language delay. For instance, Rescorla et al. (2007) found that although samples of toddlers with expressive and mixed receptive/expressive language delay both had elevated Withdrawn subscale scores on the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2000), the children with mixed receptive/expressive had higher scores (indicating more concern) than those with expressive-only delay.

In relation to neurodevelopmental outcomes, increased rates of social-emotional and behavioral problems are observed across a variety of neurodevelopmental conditions, such as Down syndrome, global developmental delay, specific language impairment, and autism spectrum disorder (Bretherton et al., 2014; Coe et al., 1999; Hartas, 2011; Hauser-Cram & Woodman, 2016a, 2016b; Merrell & Holland, 1997; van Gameren-Oosterom et al., 2011). In fact, social-emotional and behavioral problems may be among the earliest indicators for some developmental disabilities (Guinchat et al., 2012; Turygin, Matson, Williams, & Belva, 2014). Thus, it is essential that easy-to-administer screening measures identify social-emotional and behavior problems in very young children.

Until recently, few appropriate instruments were available to provide information about social-emotional and behavioral problems, along with social-emotional competencies, in infants and toddlers. A relatively new parent-report questionnaire, the Infant-Toddler Social and Emotional Assessment (ITSEA; Carter & Briggs-Gowan, 2006) assesses social-emotional and behavioral problems and competencies in 1-to-3-year-olds. The ITSEA has good reliability and evidence of both discriminant and construct validity for children as young as 12 months of age (Carter & Briggs-Gowan, 2006; Sanner, Smith, Wentzel-Larsen, & Moe, 2016). Further, it is sensitive to the degree of severity of social-emotional and behavioral problems, as it identifies young children likely to be in need of intervention (Briggs-Gowan & Carter, 2007; Carter, Briggs-Gowan, Jones, & Little, 2003; Carter, Little, Briggs-Gowan, & Kogan, 1999; Sanner et al., 2016).

In summary, while associations between social-emotional and behavioral problems and language in older children is well-documented (Bretherton et al., 2014; Hartas, 2011; Keegstra, Post, & Goorhuis-Brouwer, 2010), less is understood about how these problems may differentially relate to early language delay in the toddler years. Here, we consider a model where social-emotional and behavioral problems may impact language development in children identified with early language delays, and cause negative cascading effects that further prevent delayed language (receptive or expressive, or both) to catch up and potentially lead to further neurodevelopmental problems.

The purpose of this study was to examine the relation between language delay (defined to include children with both receptive *and* expressive language delays) and social-emotional and behavioral problems using the ITSEA in toddlers in the second year of life. Based on previous research, we hypothesized that among this sample of toddlers with language delay (identified at 18 months), more frequent and severe social-emotional and behavioral problems would be reported compared to children with no language delay. Further, we expected that across the entire sample, the *degree* of language delay would be related to social-emotional and problem behaviors, such that greater impairments in language would be concurrently associated with more problem behaviors. Finally, we explored the possibility that early social-emotional problems, while likely concurrently associated with degree of language impairment, might predict language development from 18 to 24 months.

Method

Participants

Participants were 91 toddlers, 30 with language delay (LD) and 61 with typical development (TD). Participants were drawn from an ongoing longitudinal study of language delay in toddlers, conducted at the National Institute of Mental Health and the University of Utah. Toddlers were assessed at approximately 18 months (± 2 months) and again at 24 months of age. Twenty-one TD toddlers completed the 18-month visit as a follow-up from a previous 12-month visit. All other participants completed their initial visit in the study at approximately 18 months. All participants met the following inclusion criteria at study entry: English as the primary language spoken to the child (ascertained by parent report), and no prematurity (i.e., born ≥ 36 weeks), known genetic disorder, or significant motor delay. In addition, toddlers in the LD group met the following criteria upon study entry: (a)

no known medical issue responsible for delays, (b) limited use of spoken words, (c) both receptive and expressive language scores in the Very Low range (T-scores of 30 or below) on the Mullen Scales of Early Learning (MSEL; Mullen, 1995). Toddlers in the TD group met the following criteria: (a) no impairment or delays requiring intervention, (b) no first-degree relative with a diagnosis of autism spectrum disorder, and (c) MSEL scores on all domains within normal limits (no more than 1.5 SD below the mean).

Participant demographics and characteristics are reported in Table 1. At the 18-month visit, children in the LD group had a mean age of 18.78 ± 1.45 months, and the TD group had mean age of 18.40 ± 1.01 months. At the follow-up 24-month visit, the LD group had a mean age of 24.55 ± 0.95 months; TD 24.53 ± 0.62 months. Nine participants are missing 24-month data due to moving or being lost to follow-up ($n=3$ LD; $n=2$ TD), or not completing the 24-month ITSEA ($n=1$ LD; $n=3$ TD). Race and ethnicity for this sample was largely White and non-Hispanic (70% White in the LD group and 82% in the TD group). Both groups had a high level of maternal education; 40% of the mothers in the LD group and 67% of the mothers in the TD group attended at least some graduate school. Given the potential impact of maternal education on our outcomes of interest, it was entered in all analyses as a covariate (graduate school versus no graduate school). In addition to exhibiting a delay in receptive and expressive language, some children in the LD group also scored below average in nonverbal areas (see Table 1). Both groups of children showed similar gains in receptive language from 18 to 24 months, with the LD group as a whole changing less in expressive language from 18 to 24 months. The majority of toddlers with LD were receiving early intervention services, with 57% of the LD group enrolled in intervention at 18-months and 92% at 24-months.

Study Design

Participants were recruited through local early intervention programs, flyers posted in public places (e.g., doctors' offices, children's hospitals, preschools), and word-of-mouth. Caregivers interested in the study completed a phone screening and if eligible, completed an in-person screening evaluation at 12- or 18-months (± 2 months) to determine whether the child met the entry criteria described above. If the child met entry criteria, they participated in follow-up visits at 18 (if initially evaluated at 12 months), 24, and 36 months. Data from the 18- and 24-month visits, when the ITSEA was administered, are reported here.

Measures

Infant-Toddler Social and Emotional Assessment (ITSEA; Carter & Briggs-Gowan, 2006).

The ITSEA is a caregiver-report measure aimed at identifying social-emotional problems and competencies in children ages 12 to 36 months. The ITSEA assesses four broad domains: Externalizing (Activity/Impulsivity, Aggression/Defiance, and Peer Aggression), Internalizing (Depression/Withdrawal, General Anxiety, Separation Distress, and Inhibition to Novelty), Dysregulation (Negative Emotionality, Sleep, Eating, and Sensory Sensitivity), and Competence (Compliance, Attention, Mastery Motivation, Imitation/Play, Empathy, and Prosocial Peer Relations). ITSEA domain scores are reported as T-scores with a mean of 50 and a standard deviation of 10. Problem domain scores (i.e., Externalizing, Internalizing,

Dysregulation) of 65 or higher (i.e., 1.5 SD above the mean) and Competence domain scores of 35 or lower (i.e., 1.5 SD below the mean) are considered indicative of a deficit or delay (i.e., “clinical concern”). The ITSEA has been empirically validated (Carter & Briggs-Gowan, 2006). For domain scores, internal consistency reliability coefficients for are acceptable, ranging from .85 to .90; test-retest reliability for the domains ranges from .76 to .91, and inter-rater reliability is strong, with Intraclass Correlation Coefficients ranging from .72 to .79. ITSEA scores have also been shown to be associated with scores on other measures of social-emotional and behavioral problems (Carter & Briggs-Gowan, 2006).

The ITSEA also includes additional items that form three Item Clusters: Maladaptive, Atypical, and Social Relatedness. These Item Clusters (referred to in the present study as Clinical Indices) reflect clinically significant problem behaviors that are never developmentally appropriate, and may serve as “red flags” for childhood-onset disorders. Alpha coefficients are not available for the Item Clusters since they include low occurring behaviors that may not be associated with one another (Carter & Briggs-Gowan, 2006).

Mullen Scales of Early Learning (MSEL; Mullen, 1995).

The MSEL is a standardized measure of nonverbal cognitive and language development for children from birth through 68 months. Five developmental domains are assessed including gross motor, fine motor, visual reception, receptive language, and expressive language. Internal consistency for the MSEL is acceptable, with median values ranging from 0.75 to 0.83 for the scales and a median value of 0.91 for the Early Learning Composite. Test-retest reliability ranges from 0.71 to 0.96, and interscorer reliability ranged from .91 to .99. The MSEL has been shown to have good validity, with high correlations found with other measures of motor, cognitive, and language ability in young children (Mullen, 1995).

Age equivalent scores, based on smoothed age midpoints corresponding to raw scores associated with T-scores of 50, from four domains were used in the present study: fine motor, visual reception, receptive language, and expressive language. Developmental quotients were calculated as the ratio of mental age to chronological age to characterize individual variability more fully; the nonverbal developmental quotient (NVDQ) was calculated using the mean age equivalent of the visual reception and fine motor domains, and the verbal developmental quotient (VDQ) was calculated using the mean age equivalent of the receptive and expressive language domains.

Statistical Analysis

General linear models were used to assess group differences on ITSEA subscales, to determine whether MSEL receptive and expressive language age equivalents were related to ITSEA scores, and to determine whether 18-month ITSEA scores predicted change in MSEL language between 18 and 24 months. For analyses that dealt with longitudinal data, we added repeated effects with compound symmetry covariance structures. SAS Version 9.3 Proc Mixed with maximum likelihood estimation was used, which accommodates data missing at random. However, it is not possible to verify this assumption, and given the small number of participants with missing data, we were unable to formally compare those with and without missing data on relevant study variables. Instead, we ran sensitivity analyses,

wherein each analysis was performed with those participants without 24-month data totally excluded. Statistical significance was defined as p values $< .05$; because these analyses were not the primary outcomes of the study and were therefore exploratory, no corrections were made for multiple comparisons.

Results

The results of the general linear model testing group differences in ITSEA scores are shown in Table 2 and Figure 1. The LD group had higher mean scores (more concerning) on all ITSEA Problem domains (Externalizing, Internalizing, and Dysregulation) as well as the Maladaptive and Atypical Clinical Indices at both the 18- and 24-month intervals. The LD group had a lower mean score (more concerning) for the Competence domain and for the Social Relatedness Clinical Index at both 18 and 24 months. Effect sizes associated with group differences were similar across Problem domains and the Maladaptive Clinical Index, ranging from $d = .85$ to $.93$. The Competence domain and the Social Relatedness and Atypical Clinical Indices had larger effect sizes; the 95% Confidence Intervals suggest that the magnitude of these effect sizes is different from that of the Problem domains and the Maladaptive Clinical Index, indicating that these latter areas are relatively less impaired in the LD group. The mean scores on Internalizing, Social Relatedness, and Atypical all changed to indicate improvement relative to same-age peers between 18 and 24 months (represented by decreasing Internalizing and Atypical scores and increasing Social Relatedness), but these changes did not differ significantly between groups. The results described in Table 2 did not change when NVDQ was added to the model as a covariate, nor did they differ when participants with missing data were excluded (see Supplemental Material).

However, mean differences between LD and TD are contextualized by a relatively low rate of “clinical concern” in both groups. The exceptions to this include the Competence domain and the Social Relatedness and Atypical Clinical Indices, which all had rates in the LD group of at least 50% in the clinical concern range at 18 months, with rates remaining above 50% for the Competence domain Clinical Index at 24 months (Figure 1). Specifically, for the domains, of the 26 LD children with ITSEA data at both the 18- and 24-month time points, four toddlers fell in the clinical concern range on Externalizing at 18 months, four at 24 months, and two at both time points. On the Internalizing domain, three children were in the clinical range at 18 months, two at 24 months, and one child at both time points. For the Dysregulation domain, five LD toddlers were reported to fall in the clinical concern range at 18 months and four children at 24 months, with three in the clinical concern range at both time points. On the Competence domain, 17 toddlers fell in the clinical concern range at 18 months, 16 at 24 months, and 12 at both time points.

We next explored the contemporaneous dimensional association between language ability (receptive and expressive language age equivalents) and ITSEA scores, controlling for maternal education and NVDQ. We performed this analysis irrespective of group (LD versus TD), as the grouping variable is collinear with continuous language scores. However, visual inspection of the raw data (see Figure 2) did suggest that the association between language ability and ITSEA score may be nonlinear. The slope appeared to differ at lower and higher

levels of the ITSEA score, so quadratic terms were evaluated in the repeated measures general linear model. Thus, the full initial model for each ITSEA domain (Internalizing, Externalizing, Dysregulation, Competence) included main effects of maternal education (graduate school versus not), NVDQ, and interval (18 months and 24 months), in addition to linear and quadratic terms for language age equivalent (receptive *or* expressive). An interaction with the interval term was also included for both the linear and quadratic effects of language age equivalent. Non-significant terms were excluded from the models. For all but one domain/language combination, the final model included only main effects of the covariates and a linear effect of language. However, for expressive language predicting Competence, the quadratic term was significant and was retained.

Both receptive and expressive language were significantly related to contemporaneous ITSEA scores, controlling for NVDQ and maternal education, such that lower language scores were related to more severe ITSEA scores (see Figure 2). However, this effect leveled off for Competence, such that increasing expressive language age equivalents were not associated with increasing Competence scores past approximately 20 months. The lone exception was the association of expressive language with Internalizing scores; although the effect was in the same direction as the others, it failed to reach statistical significance ($p=.07$). Full results for all models are provided (see Supplementary Table 1 in supplementary material); slope estimates for language scores predicting ITSEA scores appear in Figure 2. The results of these analyses were consistent when children with missing data were excluded (see Supplemental Material).

Finally, we explored the question of whether ITSEA domain scores at 18 months predicted change in receptive or expressive language age equivalents between 18 and 24 months. We performed these analyses in the entire sample, after first excluding the possibility that the association differed by group (i.e., all group-by-ITSEA score interactions were non-significant). Externalizing, Internalizing, and Dysregulation domain scores at 18 months did not predict change in receptive or expressive language between 18 and 24 months (Table 3). These results did not change with NVDQ added as a covariate (see Supplemental Material). Competence at 18 months predicted change in expressive language, such that higher Competence domain scores at 18 months were associated with greater increases in expressive language between 18 and 24 months. When NVDQ, which is strongly correlated with Competence scores, was added to this model, neither NVDQ nor Competence significantly predicted change in expressive language (see Supplemental Material). Sensitivity analyses omitting children with missing data yielded consistent results.

We also conducted analyses to test for the possibility that the reverse association was also present, that is, whether expressive and receptive language scores at 18 months predicted changes in ITSEA scores between 18 and 24 months, both with and without controlling for NVDQ. No significant associations were found for change in the four ITSEA domains (see Supplemental Material).

Discussion

The purpose of this study was to examine the relation between language ability and social-emotional and behavioral problems in a sample of toddlers at 18 and 24 months of age. We tested the hypothesis that children with language delay would show more social-emotional and behavioral problems compared to toddlers with no language delay. Results of the study supported this hypothesis, such that receptive and expressive language ability in toddlers was related to social-emotional and behavioral problems as measured by the ITSEA. Specifically, toddlers in the LD group had higher mean scores on all Problem domains of the ITSEA (Externalizing, Internalizing, and Dysregulation) compared with toddlers in the TD group at both 18 and 24 months. In addition, toddlers in the LD group had lower Competence scores, which includes compliance, attention, mastery motivation, imitation/play, empathy and prosocial peer relations, compared with toddlers in the TD group at both time points. Examination of effect sizes revealed large effects associated with group differences on all Problem domains as well as Competence and the three Clinical Indices (Maladaptive, Atypical, and Social Relatedness). The Competence domain and the Social Relatedness and Atypical Clinical Indices were more impaired than other areas, indicating that these may be relative differential deficits. However, neither group had mean scores in the “of concern” range (i.e., 65 for Problem domains; 35 for Competence domain), with the exception of the LD group’s Competence mean score. Competence was the only domain in which the majority of the LD group were reported to be in the clinical concern range at both 18 and 24 months. Additionally, at 18, but not 24 months, at least half of the LD group was in the range of clinical concern on both the Social Relatedness and Atypical Clinical Indices. Taken together, these findings indicate that language delays may differentially relate to problems in general competence, social relatedness, and atypical behavior, while the remaining areas are differentially less affected.

These results extend findings from previous studies examining social-emotional and behavioral problems in young children with language delays, including a study that found that toddlers with expressive language delay were reported to show lower levels of competence and marginally higher levels of internalizing problems at a mean of 27 months of age (Irwin et al., 2002). Further, the “language delayed” sample in the ITSEA examiner’s manual (aged 12–35 months) was significantly lower than a matched control group on the Competence domain, with trends in the Internalizing and Dysregulation domains, as well as Social Relatedness and Atypical item clusters in similar directions found in the present study (Carter & Briggs-Gowan, 2006). Carson et al. (1998) used the Child Behavior Checklist and found a similar pattern of marginally higher internalizing but not externalizing problems in a sample of toddlers with expressive and receptive language delays (mean age 26 months).

Differences in findings across these studies may be accounted for in part by the younger age of the current sample, extent and scope of the language delays in the current study, and variability in scores and measures used. Current findings suggest children with more significant delays in both receptive and expressive language may show problem behaviors in more areas compared to children with expressive language delay only or compared to children with more mild language delays. The present study also extends findings downward

to younger ages and explores two time points, showing that parents of children with language delays report more social-emotional and behavior problems compared to a typically developing sample as early as 18 months, and some of these differences persist 6 months later.

The current study also explored the ITSEA Clinical Indices, which have not previously been reported other than in the ITSEA manual. The Clinical Indices measure problem behaviors not commonly found in children in the general population, including maladaptive, atypical, and social relatedness problem behaviors. We found group differences in these Clinical Indices at 18 months, with the LD group showing increased problems in all of these areas. Interestingly, we also found that the LD group showed improvements relative to same-age peers in both Social Relatedness and Atypical problem behaviors from 18 to 24 months of age. However, we do note that the lack of psychometric data on the Clinical Indices, and subsequently unknown degree of structural validity, warrant caution. Specifically, while the ITSEA domains were derived through factor analysis (Carter et al., 2003), the Clinical Indices were not and their relatively small number of items and lack of normative data dictate that they must be interpreted with special care.

Importantly, however, using combined data from both groups of toddlers, we see a dimensional association between language and problem behaviors at both 18 and 24 months of age. Specifically, the degree of language impairment—not just the presence of a delay—is associated with the degree of social-emotional or problem behaviors. The lone exception was that expressive language was not associated with contemporaneous Internalizing scores. In addition, one nonlinear association was identified, such that increasing expressive language age equivalents were not associated with increasing Competence scores above expressive language scores of about 20-month age equivalents. These analyses provide some evidence of an association between social-emotional and behavioral problems and language development in children as young as 18 months.

The limited research examining the association between severity or type of language delay and social-emotional functioning in younger children has produced inconsistent results (e.g., Henrichs et al., 2013; Rescorla et al., 2007). In the present sample of toddlers, higher levels of social-emotional and behavioral problems were associated with lower receptive and expressive language measured concurrently, controlling for the possible impact of general nonverbal cognitive ability and maternal education. Further research is needed to replicate this and test whether these findings merely represent an artifact of measurement. For example, it is possible that language scores reflect cognitive, attentional or other behavior problems in addition to language, such that children with language delays may have greater problems with compliancy in completion of standardized language tests compared to children without such delays. It is also possible that a potentially reciprocal or bidirectional association exists between social-emotional and behavior problems and language. In the future, longitudinal samples that include data points before the language delay emerges and enough participants may be studied using a structural modeling statistical approach to explore such bidirectional models.

We conducted exploratory analyses testing whether baseline ITSEA scores were predictive of change in language from 18 to 24 months of age, aimed at understanding whether social-emotional and behavioral problems early on may actually be masked as language problems. If so, fewer social-emotional or behavioral problems at 18 months would predict greater increases in language between 18 and 24 months. However, for children with underlying neurodevelopmental problems, early problematic scores on the ITSEA (i.e., higher social-emotional and behavior problems) may result in little-to-no change in language over time, indicating a negative association between 18-month ITSEA scores and change in language on the MSEL (higher ITSEA = lower change score). While competency at 18 months predicted improved expressive language between 18 and 24 months, providing some evidence that early general competency portends the ability to learn language, we did not see strong evidence of either of these patterns in this exploratory analysis based on our small sample size. However, future research with a larger dataset that includes additional information regarding child outcomes (e.g. exploring a greater number of time points and sufficient statistical power and variability to explore more fully factors such as changes in cognitive ability) will help elucidate these patterns.

Clinical Implications

Findings of this study confirm the importance of early screening for social-emotional problems in toddlers, with research needed to further examine social-emotional functioning among young children with developmental delays, including language delay, by continuing to follow toddlers for longer periods of time to assess longitudinal outcomes. Given the association of social-emotional and behavioral problems to language development, early detection and treatment of elevated problems in these areas in infants and toddlers may potentially reduce their impact on young children and their families. Findings from several recent studies demonstrate the effectiveness of early intervention on improving the language outcomes of infants and toddlers with or at-risk for language delays (Burgoyne, Gardner, Whiteley, Snowling, & Hulme, 2017; McGillion, Pine, Herbert, & Matthews, 2017). Further, emerging evidence supports the effectiveness of interventions, including parent-led language intervention, on reducing problem behaviors in young children with language delays, which may occur through several mechanisms that impact both the parent's and child's behavior (Curtis, Kaiser, Estabrook, & Roberts, 2017).

Limitations and Future Research

While the findings from this study add to the existing literature on the social-emotional functioning of very young children, some potential limitations should also be considered, including the small sample size, particularly of the language delay group, and examination of only one method of assessment (parent-report from the ITSEA). Data gathered from multiple sources, as well as observational measures, may provide a broader or more comprehensive view of toddlers' social-emotional functioning.

The current study utilized a dimensional approach to explore language delay in relation to social-emotional development, but given the sample size and questions we sought to explore, we did not include other measures that may influence these. Large, population-based studies that have also shown that language delays are associated with social-emotional problems in

toddlers (Sim et al., 2013) would be ideal for understanding demographic and other risk factors that contribute to the combination of language and social-emotional problems at early ages. Further, studies of preschool and school-aged children have identified possible mediators between language and social emotional/behavioral problems (Menting, van Lier, & Koot, 2011; Tomblin, Zhang, Buckwalter, & Catts, 2000); examining mediators of the association between language abilities and social emotional/behavioral problems in toddler years is an important next step to increase our understanding of how these constructs relate.

Future research should explore early language delay and social-emotional problems further out in development, when additional outcomes such as autism spectrum disorder, attention-deficit/hyperactivity disorder, and intellectual disability can be considered, as well as more subtle continuing delays. Larger samples of children with identified risk factors at early ages will be necessary for statistical modeling of these varied outcomes to adequately explore a fuller range of potential modifiers of these relations, and to identify the nature of the associations between early language development, social-emotional difficulties and outcomes in children.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.

Mean ITSEA scores (and proportion in the clinical range) by group and interval (18 and 24 months). Figure depicts the mean and standard deviation for ITSEA domain scores (Panel A) and Clinical Indices (Panel B). The proportion of the group in the range of clinical concern is printed above each bar (i.e., 20% of the LD group was in the clinical range on Internalizing at 18 months).

Figure 2.

Relationship between Mullen language scores and ITSEA domain scores in 18 and 24 month olds. $^{**}p<.01$, $^*p<.05$. Values from the LD group are represented by black circles, typical group values are represented by unfilled squares. ITSEA=Infant Toddler Social Emotional Assessment; CI=confidence interval. Results of a repeated measures general linear model of Mullen Age Equivalent predicting ITSEA Tscore, controlling for NVDQ and maternal education (not pictured). Quadratic terms were non-significant where not pictured.

Table 1.

Summary of Participant Demographics and Characteristics

	LD (M $\pm$ SD; Range)		TD (M $\pm$ SD; Range)	
	18 Month (N=30)	24 Month (N=26)	18 Month (N=61)	24 Month (N=56)
Age in months	18.78 $\pm$ 1.45	24.55 $\pm$ 0.95	18.49 $\pm$ 1.01	24.53 $\pm$ 0.62
Race and Ethnicity				
White	21 (70%)		50 (82%)	
African-American	6 (20%)		3 (5%)	
Other	3 (10%)		8 (13%)	
Non-Hispanic	23 (77%)		55 (90%)	
Maternal education				
High school graduate	2 (7%)		2 (3%)	
Some college/college graduate	15 (50%)		17 (28%)	
Graduate school	12 (40%)		41 (67%)	
Not reported	1 (3%)		1 (2%)	
Male	21 (70%)		35 (57%)	
Mullen Scales of Early Learning				
Receptive Age Equivalent	9.23 $\pm$ 3.41; 1–14	17.03 $\pm$ 7.09; 4–31	20.82 $\pm$ 4.08; 14–28	28.93 $\pm$ 3.61; 23–37
Receptive Change (18 to 24 months)		8.00 $\pm$ 6.83		8.05 $\pm$ 4.08
Expressive Age Equivalent	9.23 $\pm$ 2.69; 2–13	15.46 $\pm$ 4.18; 8–22	17.59 $\pm$ 2.40; 13–23	27.93 $\pm$ 5.51; 20–39
Expressive Change (18 to 24 months)		5.96 $\pm$ 3.65		10.43 $\pm$ 5.16
Visual Reception Age Equivalent	16.27 $\pm$ 3.86; 3–25	22.00 $\pm$ 4.63; 13–30	20.16 $\pm$ 2.62; 15–27	27.98 $\pm$ 3.65; 20–37
Fine Motor Age Equivalent	17.20 $\pm$ 3.17; 7–21	22.19 $\pm$ 4.02; 16–30	19.74 $\pm$ 1.72; 17–24	25.86 $\pm$ 2.70; 20–31
Nonverbal DQ	89.22 $\pm$ 17.54; 29–110	90.24 $\pm$ 17.66; 52–123	107.81 $\pm$ 9.04; 88–127	109.51 $\pm$ 10.45; 83–136
Verbal DQ	49.07 $\pm$ 14.06; 9–71	66.40 $\pm$ 21.41; 29–104	103.51 $\pm$ 13.48; 78–137	115.58 $\pm$ 15.53; 90–153

Note. Because some children achieved the lowest possible standard score on the Mullen Scales of Early Learning, Developmental Quotients (DQ), based on age equivalents divided by chronological age X 100, were used to more fully characterize individual variation. Nonverbal DQ was calculated from the average of the Fine Motor and Visual Reception scales, and Verbal DQ from the average of the Receptive and Expressive Language scales.

Table 2.

Between-group Comparison of ITSEA Scores

	DF	F Value	<i>p</i>	Cohen's <i>d</i> (95% CI)
Externalizing				
Group	87	18.82	<.0001	0.93 (0.5–1.36)
Interval	79	0.93	.34	
Group*Interval	79	0.92	.34	
Maternal Education	87	4.38	.04	
Internalizing				
Group	87	15.83	.0001	0.85 (0.43–1.28)
Interval	79	4.31	.04	
Group*Interval	79	0.28	.60	
Maternal Education	87	1.44	.23	
Dysregulation				
Group	87	17.46	<.0001	0.90 (0.47–1.32)
Interval	79	1.82	.18	
Group*Interval	79	1.06	.31	
Maternal Education	87	0.04	.84	
Competence				
Group	87	54.11	<.0001	–1.58 (–2.00 – –1.15)
Interval	79	0.56	.46	
Group*Interval	79	0.04	.84	
Maternal Education	87	0.56	.45	
Maladaptive				
Group	87	17.26	<.0001	0.89 (0.46–1.32)
Interval	78	0.14	.71	
Group*Interval	78	0.06	.80	
Maternal Education	87	0.24	.63	
Social Relatedness				
Group	87	43.95	<.0001	–1.42 (–1.85 – –1.00)
Interval	79	4.66	.03	
Group*Interval	79	2.53	.12	
Maternal Education	87	0.34	.56	
Atypical				
Group	87	81.83	<.0001	1.94 (1.51–2.37)
Interval	79	8.56	.00	
Group*Interval	79	3.95	.05	
Maternal Education	87	0.28	.60	

Note: These are the results of a repeated measures general linear model with maximum likelihood estimation (reference categories were Group=Typical, Interval=24 Month, and Maternal Education=At least some graduate school). Observed mean scores by group and interval (18 and 24 months) are found in Figure 1. Cohen's *d* was calculated with pooled standard deviation, using least square estimated values from the general linear model.

Table 3.

Relationship between 18-month ITSEA scores and change in MSEL language between 18 and 24 months

	DF	F	p	Slope Estimate	95% Confidence Interval
Dependent variable: Change in receptive age equivalent, 18–24 months					
Maternal Education	78	0.03	0.87		
ITSEA Externalizing 18 Months	78	0.41	0.52	−0.041	(−0.17 – 0.09)
Maternal Education	78	0.07	0.79		
ITSEA Internalizing 18 Months	78	0.73	0.39	−0.048	(−0.16 – 0.06)
Maternal Education	78	0.14	0.71		
ITSEA Dysfunction 18 Months	78	0.92	0.34	−0.038	(−0.12 – 0.04)
Maternal Education	78	0.14	0.71		
ITSEA Competence 18 Months	78	1.08	0.30	0.046	(−0.04 – 0.13)
Dependent variable: Change in expressive age equivalent, 18–24 months					
Maternal Education	78	0.28	0.60		
ITSEA Externalizing 18 Months	78	1.13	0.29	−0.070	(−0.20 – 0.06)
Maternal Education	78	0.56	0.46		
ITSEA Internalizing 18 Months	78	1.57	0.21	−0.072	(−0.19 – 0.04)
Maternal Education	78	0.8	0.37		
ITSEA Dysfunction 18 Months	78	1.9	0.17	−0.055	(−0.14 – 0.02)
Maternal Education	78	0.84	0.36		
ITSEA Competence 18 Months	78	7.14	0.009	0.116	(0.03 – 0.20)

Note: MSEL=Mullen Scales of Early Learning; ITSEA=Infant Toddler Social Emotional Assessment. These are the results of a general linear model with maximum likelihood estimation, where 18-month ITSEA scores were entered as predictors of change in MSEL language age equivalent (in months) from 18 months. Unstandardized slope is interpreted as the estimated change in the dependent variable (DV, MSEL Age Equivalent) with a one-unit change in the predictor variable (ITSEA T-score).