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Early vocabulary development: Relationships with prelinguistic skills and early social-emotional/behavioral problems and competencies

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Abstract

The aim of this longitudinal study was to investigate early vocabulary development and its relationships with prelinguistic communication skills and social-emotional/behavioral (SEB[1]) problems and competencies. The participants were 58 healthy Finnish-speaking children (30 girls, 28 boys). First, the concurrent relationships were investigated at the age of 18 months. Second, the relationships between prelinguistic communication skills and SEB problems and competencies at 18 months, and subsequent vocabulary scores at 24 and 30 months, were examined. Parental reports on early vocabulary (MacArthur Communicative Developmental Inventories; MCDI), prelinguistic communication skills (The Infant-Toddler Checklist of the Communication and Symbolic Behavior Scales Developmental Profile; ITC), SEB problems and competencies (Brief Infant-Toddler Social and Emotional Assessment; BITSEA) were gathered. Compared to boys, girls scored significantly higher on ITC Speech Composite at 18 months and expressive vocabulary measures at 18, 24, and 30 months. Vocabulary, as well as prelinguistic communication measures, correlated with SEB competencies at 18 months. Furthermore, vocabulary, as well as ITC Symbolic Composite and Total Score, correlated negatively with externalizing problem and SEB Total Problem scores. With regard to subsequent vocabulary development, all of the prelinguistic communication measures at 18 months correlated with vocabulary at 24 and 30 months. However, when accounted for gender and earlier vocabulary, only the associations with ITC Speech Composite and Total Score at 24 months remained significant. SEB Competencies at 18 months correlated positively, while externalizing problems at 18 months correlated negatively with vocabulary at 24 and 30 months, however, these associations did not remain significant, when accounted for gender and earlier vocabulary.

Keywords: early vocabulary, late talkers, prelinguistic development, social-emotional development

[1] social-emotional/behavioral

1. INTRODUCTION

It is an ongoing challenge to identify risk factors for language impairment (McKean et al., 2017). It is known that there are several genetic and environmental factors that influence not only the development of children's linguistic skills but also the development of other social and emotional competencies (Rutter, 2003). Furthermore, there is a consensus about a substantial comorbidity between language and social-emotional and behavioral (SEB) problems in school-age children (Hughes, Sciberras & Goldfeld, 2016; McCabe & Meller, 2004; Qi & Kaiser, 2004), adolescents (Beitchman et al., 2001; Bryan, Freer & Furlong, 2007; Conti-Ramsden & Botting, 2004), and adults (Brownlie et al., 2004). Among 4- to 19-year-old children and adolescents with language problems, 57% have been evidenced to have significant SEB problems, and among children with SEB problems, 71% have been evidenced to have language problems (Benner, Nelson & Epstein, 2002, review). Hence, the search for potential early risk factors for language impairment should be expanded beyond language measures only. Early screening and early intervention could alter a child's developmental trajectory, enhance the quality of life of the family, and decrease the cost of intervention (Gibbard, Coglan & MacDonald, 2004). However, little research has been conducted to show the connection between language and SEB problems and competencies in children under the age of 3 years. This study examines the relationships between vocabulary and prelinguistic skills as well as SEB problems and competencies in 18- to 30-month-old children.

The term prelinguistic communication refers to a developmental period before a child has a linguistic system for acquiring language, and the prelinguistic stage can be considered to continue until the child can produce creative word combinations and vocabulary growth is rapid (Wetherby, Reichle & Pierce, 1998; Wetherby, Warren & Reichle, 1998, p. 4). Prelinguistic communication has been proved to predict later expressive and receptive language (Ben-Sasson & Gill, 2014; Laakso, Poikkeus, Katajamäki & Lyytinen, 1999; Wetherby, Goldstein, Cleary, Allen & Kublin, 2003), and expressive and receptive vocabulary (Fenson et al., 1994). Explicitly, it seems that the predictive value of prelinguistic skills can change in 1- to 2-year-old typically developing children (Watt, Wetherby & Shumway, 2006). Within a year in early development, an individual skill, such as joint attention or gestures, may at one age predict only expressive language, and at another age only receptive language, or both expressive and receptive language (O´Neill, Murphy & Chiat, 2019; Watt et al., 2006). Most studies have suggested that problems in symbolic, social, or all symbolic, social and speech-related prelinguistic skills seem to be a bigger risk factor for later language problems than those in sound and speech production only (Chiat & Roy, 2008; Määttä, Laakso, Tolvanen, Ahonen & Aro, 2014; Watt

et al., 2006). Prelinguistic symbolic communication skills have been evidenced to correlate with receptive language, and prelinguistic speech skills with expressive language (Vehkavuori & Stolt, 2018; Watt et al., 2006). Conversely, prelinguistic social communication skills have correlated with subsequent receptive and expressive language (Watt et al., 2006; see also Fenson et al., 1994), or have not correlated with concurrent receptive or expressive language at the age of 2 years (Vehkavuori et al, 2018).

Prelinguistic communication is widely considered as part of a continuum with later language (Bruner, 1986; Cochet & Byrne, 2016; Crais, Watson & Baranek, 2009; Reddy, 1999; Tomasello, 2010; Watt et al., 2006; Wu & Gros-Louis, 2014). On average, children say their first words at around 12–13 months, but there is much normal variation in early language skills (Fenson et al., 1994; Rescorla, 2000). For the first few months, words accumulate slowly, followed by a sharp acceleration in word production at around 18 to 20 months, on average. Late talking is conceptualized as a child of 24 months having no more than 50 words or no word combinations (Rescorla, 1989). Late talking is common, and 10–15% of children can be identified as late talkers (Horwitz et al., 2003; Rescorla & Alley, 2001; Zubrick, Taylor, Rice & Slegers, 2007). Around 50% of late talkers catch up in their language skills by the age of 4 or 5 years. Even if late talkers catch up in language skills, they have been found to be at risk for problems in later academic and literacy skills (Lyytinen, Eklund & Lyytinen, 2005; Preston, et al., 2010; Rescorla, 2002; Rice, Taylor & Zubrick, 2008) and, for example, problems in speech accuracy (Neam, Baker, Hodges & Munro, 2019). There is huge variation, from 2–44%, in the estimated proportion of late talkers who go on to display persistent language difficulties (Dale, Price, Bishop & Plomin, 2003; Nelson, Nygren, Walker & Panoscha, 2006; Rescorla, 2002).

When seeking early risk profiles for language impairment beyond just language measures, SEB problems and competencies may be useful. SEB problems in young children are defined as falling into the domains of externalizing, internalizing, and dysregulation (Briggs-Gowan, Carter, Bosson-Heenan, Guyer & Horwitz, 2006). Externalizing problems include aggression, overactivity, impulsivity, and inattention. Internalizing problems include anxiety, depression/withdrawal, fears, and shyness/inhibition. Dysregulation includes problems with state, affect, and sensory processing. SEB competencies are adaptive characteristics that encompass many related interpersonal skills (Bornstein, Hahn & Haynes, 2010; Rose-Krasnor, 1997). Social competence in children manifests in emotional self-regulation, social cognition, empathy, positive communication, and prosocial relationships with family members, peers, and teachers. Prior studies show that elevated SEB problem levels are found in about 12–33% of 14- to 24-month-old children (Briggs-Gowan, Carter, Skuban &

Horwitz, 2001; Möricke, Lappenschaar, Swinkels, Rommelse & Buitelaar, 2013; Skovgaard et al, 2007). In addition to the possible aid in screening for persistent language problems, identifying and intervening in early SEB developmental problems could be clinically significant, considering a substantial proportion of early SEB problems are not perceived to be transient (Briggs-Gowan et al., 2006; Briggs-Gowan & Carter, 2008; Möricke et al., 2013; Skovgaard et al., 2007). Specifically, in young children aged 18 to 36 months, 37–50% of SEB problems have been found to continue 1 to 3 years after onset (Briggs-Gowan et al., 2006; Lavigne, Arend & Rosenbaum, 1998; Mathiesen & Sanson, 2000).

Mental health problems, as well as language problems, may be hard to detect in children under the age of 3 years, especially when most of the assessment tools at this age are parental reports (Manning et al., 2019). Furthermore, reduced language ability seems to be a greater risk for SEB problems in older children. Still, there has been a connection between late talking and SEB problems and competencies, but the findings have been less consistent in the case of milder and emerging language problems than in later childhood, adolescence, and adulthood. Specifically, late talkers under 36 months old have been identified to be both more withdrawn in parent questionnaires (Irwin, Carter & Briggs-Gowan, 2002; Rescorla, Ross & McClure, 2007), and more serious and less interested in play session recordings than a control group of children (Irwin et al., 2002). Additionally, Manning and her group (2019) examined children from the age of 12 months to 38 months in a recent population-based study (N=2001). They found emergent language and SEB problem risk to be comorbid under the age of 3 years. Late talkers had double the risk of severe tantrums than the control group. The research group claimed this was the first population-based evidence of a connection between expressive emergent language and mental health risk at such an early age. Children with a diagnosis of developmental delay were not included in the study. Similarly, 18-month-old children with expressive vocabulary delay have been perceived to have more contemporaneous internalizing problems than a control group (Heinrichs et al., 2013), and 24-month-old late talkers to have more externalizing and internalizing problems than a control group (Whitehouse, Robinson & Zubrick, 2011). However, effect sizes were small. Likewise, Dionne, Tremblay, Boivin, Laplante, and Pérusse (2003) found a modest correlation between language and behavior problems at the age of 19 months, and Sim and her group (2013) found two out of three 30-month-old children with language delay to have co-occurring SEB problems. Additionally, Horwitz and her group (2003) found a correlation between externalizing behavior problems and expressive language delay at the age of 30 to 39 months. They also suggested, that when social competence is adjusted for in the multivariate model, behavior problems are no longer associated with language delay between the ages of 18 to 29 months.

Thus, social competence may be the critical early correlate of low expressive language development. Also, Thurm and her group (2018) reached similar conclusions. Social competence was the only aspect that reached clinical concern rate in a language delayed group of 18- and 24-month-old children. By contrast, in many studies, there has been no evidence of correlation between late talking and social-emotional development (Rescorla & Achenbach, 2002; Rescorla & Alley, 2001), or between late talking and behavioral problems in young children (Carson, Klee, Perry, Muskina & Donaghy, 1998; Rescorla et al., 2007).

Some prior research has investigated the relations between expressive language and subsequent SEB problems and competencies. Vocabulary delay at 18 and 30 months has resulted in both internalizing and externalizing problems at 36 months (Heinrichs et al., 2013). Furthermore, low language ability at 17 months has predicted aggression at 29 months (Girard et al., 2014). The effect sizes were small. Even fewer studies have investigated the effect of SEB problems and competencies on later language ability. For example, anger expressions at 18 months have predicted lower expressive language at 30 months (Nozadi et al., 2013). In addition, attention in free-play tasks at 9 months has predicted expressive vocabulary at 31 months (Kannass & Oakes, 2010). Furthermore, Oliver, Dale, and Plomin (2004) investigated behavior at 2 years of age to predict later language at 4 years of age significantly but modestly.

Finally, a significant aspect to take into consideration is that gender may affect the relations between language and SEB problems and competencies (Longobardi, Spataro, Frigerio & Rescorla, 2016). With regard to vocabulary skills, girls have been shown to have larger productive vocabularies than boys in the early years (Bavin, Prior, Reilly, Bretherton & Ukoumunne, 2008; Eriksson et al., 2011; Fenson, et al. 1994; Galsworthy, Dionne, Dale & Plomin, 2000; Horwitz et al., 2003; Law, Clegg, Rush, Roulstone & Peters, 2018; Paavola, Kunnari & Moilanen, 2005; Reilly et al., 2007). Some studies have evidenced the gender difference also in speech comprehension between 8 and 16 months (Fenson et al., 1994) and between 10 and 36 months of age (Krogh & Væver, 2019). Altogether, variance due to gender difference in language in the toddler years is usually reckoned to be small, at around 1 to 3 percent of the linguistic outcome. Analogous to the case of vocabulary skills, there seems to be a female advantage in the development of prelinguistic skills. Eriksson and his group (2011) found in a very large-scale study (N = 13783) of 8 to 30-month-old children that girls outperform boys in early communicative gestures and infant word production (see also Fenson et al., 1994; Reilly et al., 2007). In contrast to the clear gender differences in early vocabulary and prelinguistic skills, prior studies have had mixed results for early SEB problems and competencies in girls and boys. In some studies of children under the age of 3 years, girls had more social competence

than boys (Alakortes, Fyrstén, Carter, Moilanen & Ebeling, 2015; Briggs-Gowan et al., 2001; Squires, Bricker, Heo & Twombly, 2001), and boys had more problem behavior than girls (Alakortes et al., 2015; Briggs-Gowan, Carter, Irwin, Wachtel & Cicchetti, 2004; Coie & Dodge, 1998, review; Rubin, Burgess, Dwyer & Hastings, 2003). Boys have been evidenced to have more externalizing problems at 14 and 19 months (Beernink, Swinkels & Buitelaar, 2007), and to be more inattentive, hyperactive, and aggressive at 17 months (Baillargeon et al., 2007). Gender has also moderated the strength of the association between expressive language and social ability in 18 to 35-month-old children, accounting for 2 to 3 percent of the variance (Longobardi et al., 2016). Additionally, Nozadi and her group (2013) stated that anger expressions during an emotion-eliciting task are associated with lower language in boys but not in girls under the age of 3 years. Conversely, many studies showed no statistically significant gender difference in social competence or problem behavior at a young age (Baillargeon, Sward, Keenan & Cao, 2011; Briggs-Gowan et al., 2001; Briggs-Gowan et al., 2006; Lavigne et al., 1998; Rescorla, & Achenbach, 2002, Skovgaard et al., 2007). In slightly older children, from 1 to 5 years, boys have been found to have more externalizing, neurodevelopmental, and/or overall SEB problems than girls (Baillargeon et al., 2007; Beernink et al., 2007; Carter & Briggs-Gowan, 2006; Rescorla et al., 2011).

The aim of this study was to investigate the role of prelinguistic skills and SEB problems and competencies at 18 months to concurrent and subsequent vocabulary development.

We sought answers to the following questions:

1. Are there gender differences in prelinguistic skills and SEB problems and competencies at the age of 18 months and in vocabulary skills at the ages of 18, 24, and 30 months?

2. Are there concurrent relationships between children's vocabulary, prelinguistic skills and SEB problems and competencies at the age of 18 months?

3. Do prelinguistic skills at the age of 18 months correlate with vocabulary at the ages of 24 and 30 months?

4. Do SEB problems and competencies at the age of 18 months correlate with vocabulary at the ages of 24 and 30 months?

2. PARTICIPANTS AND METHODS

2.1 Participants

The participants were 58 healthy children (28 boys and 30 girls). They were recruited from child-health centers during their 18-month routine check-up, from open family clubs, or via social media. The children had to meet the following inclusion criteria: (1) full-term birth (gestational weeks 37+) after normal pregnancy and delivery, (2) no diagnosed mental or physical disability or major disorder, (3) no suspicion of autism spectrum disorders, (4) neither diagnosed nor suspected hearing impairment, (5) no malformations in the oral or facial area (e.g. cleft palate). All the children were living in native Finnish-speaking families with both their biological parents, or at least with their biological mother.

The mean age of the mothers at childbirth was approximately 30 years (SD 4.2, range 21–38), and it was 32 years (SD 5.5, range 22–74) for fathers. The parents were relatively well educated. Based on the International Standard Classification of Education (ISCED, 2011), the mothers of the present sample had attained considerably higher education than 20- to 34-year-old women in Finland in 2017: tertiary education (e.g. polytechnic, university) 71% vs. 32%, post-secondary non-tertiary education (e.g. college) 5% vs. < 1%, upper secondary education 22% vs. 53%, and basic education (a comprehensive school) 2% vs. 14% (Statistics Finland's PX-Web databases, 2017). Equivalent figures for the fathers were: 62% vs. 20%, 5% vs. < 1%, 31% vs. 61%, and 2% vs. 19%, respectively.

2.2 Procedure

The present data set represents a subset of a wider longitudinal follow-up study concerning factors that may have a role in explaining variation in early language acquisition. The data collection was carried out in the cities of Oulu and Kouvola, Finland, and their surrounding vicinities, between the years 2012–2018. The study design was approved by the Regional Ethics Committee of the Northern Ostrobothnia Hospital District, Oulu, Finland. Written informed consent to participate was obtained from the parents.

Immediately after recruitment, when the child was aged 18 months, the Finnish validated version of the MacArthur Communicative Development Inventories (MCDI; Fenson et al., 1994; Lyytinen,

1999), the Finnish validated version of the Infant-Toddler Checklist of the Communication and Symbolic Behavior Scales – Developmental Profile (the ITC of the CSBS-DP; Laakso, Poikkeus & Eklund, 2011; Wetherby & Prizant, 2002), and the Finnish translation of the Brief Infant-Toddler Social and Emotional Assessment (BITSEA; Briggs-Gowan & Carter, 2006; for translation details, see Alakortes, 2018) were sent to parents alongside background information questionnaires. Thereafter, the parents returned the completed questionnaires to the researchers in pre-paid envelopes. At ages 24 and 30 months, the MCDI was again sent to the parents and collected at the time of home visits. During home visits some additional data was collected, however, it is presented elsewhere. All of the 58 children were included in the data sets of each age points.

2.3 Measures

2.3.1 Measures of child communicative skills and vocabulary

With regard to the MCDI (Fenson et al., 1994), the toddler form that is designed for children aged 16 to 30 months was used in the present study. It gives information on vocabulary and early capacity to combine words into sentences. The questionnaire includes a predefined vocabulary checklist of 595 words and a checklist of common inflections. Parents are also asked to write down the three longest sentences their child has produced. For the purposes of the present study, the only measure that was used was the number of words (i.e. vocabulary scores). The scales in the MCDI demonstrate high internal consistency and good test-retest reliability (see Law & Roy, 2008; Lyytinen, 1999).

The ITC of the CSBS-DP (Wetherby & Prizant, 2002) is a parent report instrument that measures prelinguistic milestones in early communication and language development in children aged 6 to 24 months. The ITC consists of 24 questions that measure seven communication clusters divided into three composites. The Social Composite consists of 13 questions concerning emotions, the use of eye contact, communication, and gestures. The Speech Composite consists of five questions that survey sound and word production. The Symbolic Composite contains six questions related to understanding and object use. The ratings are either on a three-point scale (0 = not yet, 1 = sometimes, 2 = often) or on scales scoring 0 to 4 points, resulting in a maximum possible score of 26 for the Social Composite, 14 for the Speech Composite, and 17 for the Symbolic Composite. In addition, the ITC Total Score was calculated (range 0–57). Internal consistencies were acceptable or at least marginal for the ITC Total, Social Composite, and Speech Composite: Cronbach's alphas were 0.75, 0.62, and 0.69, respectively. For the Symbolic Composite, the alpha was 0.42, indicating low internal consistency.

In the Finnish validation data (Laakso et al., 2011), the alpha for the ITC Total at age 18 months was 0.82, and for the Social, Speech, and Symbolic Composite, it was 0.70, 0.60, and 0.53, respectively.

2.3.2 BITSEA

BITSEA (Briggs-Cowan & Carter, 2006) is a parent report screening measure for the detection of possible SEB problems and delays/deficits in SEB competencies in 12- to 35-month-old children. It can be considered one of the most evidence-based screening measures in this field (e.g., Bagner, Rodríguez, Blake, Linares & Carter, 2012; Szaniecki & Barnes, 2016). The questionnaire was originally translated into Finnish for a pilot study (Haapsamo et al., 2009). Subsequently, the original and back-translated versions were compared and minor corrections were made to the final Finnish translations (Alakortes et al., 2017). The BITSEA questionnaire consists of 42 items. Altogether, 31 of these items address problematic behavior mainly in externalizing (e.g. impulsivity, defiance, peer aggression), internalizing (e.g. fearfulness, worry, anxiety, sadness), and dysregulation (e.g. sleep and eating problems, negative emotionality, sensory sensitivities). The 11 competence items rate attention, compliance, mastery motivation, prosocial peer relations, empathy, imitation/play, and social relatedness. There are also items that address behaviors that may be early markers of autism spectrum disorders or other serious psychopathology. The possible responses for each item are: Not true/rarely (= 0), Somewhat true/sometimes (= 1), and Very true/often (= 2). For the purposes of the present study, the Problem Total (range 0–62) and Competence Total (range 0–22), as well as the externalizing (range 0–12), internalizing (range 0–16), and dysregulation (range 0–16) problem domain scores, were calculated. With regard to internal consistencies, they were acceptable or at least marginal for Problem Total, Competence Total, and externalizing problem domain scores: Cronbach's alphas were 0.71, 0.72, and 0.61, respectively. By contrast, alphas for internalizing and dysregulation problem domain scores indicated low internal consistency: 0.33 and 0.46, respectively.

2.4 Statistical analyses

Statistical analyses were produced using SPSS version 25.0 for Windows. The mean (M), median (md), standard deviation (SD), and ranges were chosen to describe the distribution and amount of variation in the data. The Kolmogorov-Smirnov test was used to examine the distributions of the variables. According to the test, some of the variables deviated from normal distribution. However, histograms with normal curves indicated that the distributions of all the variables were at least close

to normal. Hence, parametric tests were chosen for the statistical analyses of the data. Statistical comparisons of the separate groups of boys and girls were carried out using Student's t-test for two independent samples. To illustrate the clinical significance, Cohen's d was used as a measure of effect size for statistically significant score differences. According to Cohen (1988), d at around 0.8 can be considered a large effect, whereas d at around 0.5 reflects a medium and 0.2 a small effect. The possible concurrent relationships between children's vocabulary and prelinguistic communicative capacities, as well as the measures of SEB problems and competencies, at 18 months were investigated using Pearson product-moment correlations. Pearson product-moment correlations were also used to examine the associations of prelinguistic communicative capacities and vocabulary measures at 24 and 30 months, as well as the relationships between children's SEB problems and competencies and subsequent vocabulary skills. Furthermore, partial correlations controlling for the child gender as well as earlier vocabulary measures were used. In all of the analyses, p values $< .05$ were considered statistically significant.

3. RESULTS

The results are reported in four sections. First, we report the descriptive statistics and the possible gender differences in vocabulary, prelinguistic communication skills, and SEB problems and competencies. Second, we investigate the relationships between concurrent vocabulary, prelinguistic communication skills, and concurrent SEB problems and competencies. Third, we investigate the relationships between prelinguistic communication skills and subsequent vocabulary. Finally, the relationships between SEB problems and competencies and subsequent vocabulary development are investigated.

3.1 Descriptive statistics and gender differences

Table 1 contains descriptive statistics for the children's prelinguistic communication skills (ITC of the CSBS-DP) at 18 months and vocabulary scores (MCDI) at 18, 24, and 30 months. The scores for the whole group of children, as well as for the boys and girls separately, are presented. Girls had higher scores than boys in the measures of prelinguistic communication skills. For the ITC Total and Speech Composite, the differences were statistically significant. The same was true for MCDI scores at 18, 24, and 30 months. The effect sizes for the statistically significant differences were all large.

TABLE 1. Descriptive statistics for prelinguistic communication skills (ITC of the CSBS-DP) at 18 months and vocabulary (MCDI) at 18, 24, and 30 months

Measure	All (N = 58) Mean (SD) Median Range	Boys (n = 28) Mean (SD) Median Range	Girls (n = 30) Mean (SD) Median Range
18 months			
ICT Total[a]	47.24 (5.66) 49 30–56	45.25 (6.02) 46 30–54	49.10 (4.68) 49 40–56
Social[b]	21.97 (2.55) 22 15–26	21.61 (2.70) 21 15–26	22.30 (2.41) 23 17–26
Speech[c]	10.41 (3.02) 11 3–14	9.07 (3.21) 10 3–14	11.67 (2.22) 12 6–14
Symbolic[d]	14.74 (1.91) 15 8–17	14.25 (2.17) 15 8–17	15.20 (1.52) 16 12–17
MCDI[e]	82.81 (101.38) 37 0–422	34.29 (52.45) 15 0–243	128.10 (115.08) 92 8–422

(continued)

TABLE 1. Descriptive statistics for prelinguistic communication skills (ITC of the CSBS-DP) at 18 months and vocabulary (MCDI) at 18, 24, and 30 months (continued)

Measure	All (N = 58) Mean (SD) Median Range	Boys (n = 28) Mean (SD) Median Range	Girls (n = 30) Mean (SD) Median Range
24 months			
MCDI[f]	247.71 (154.56) 254 8–574	175.25 (147.54) 105 8–416	315.33 (129.96) 307 84–574
30 months			
MCDI[g]	417.47 (154.91) 481 11–590	352.04 (185.61) 415 11–566	478.53 (84.26) 510 298–590

Note. Student's t-test for two independent samples was used. Effect size (*d*) was calculated for the difference between the two means, if the difference between the corresponding scores was statistically significant ($p < .05$).

Significance of the difference between the scores in the groups of boys and girls: [a]$t(56) = -2.73$, 95% CI -6.67–(-1.03), $p = .008$, $d = 0.71$; [b]$t(56) = -1.03$, 95% CI -2.04–0.65, $p = .306$; [c]$t(56) = -3.60$, 95% CI -4.04–(-1.15), $p = .001$, $d = 1.18$; [d]$t(56) = -1.94$, 95% CI -1.93–0.03, $p = .057$; [e]$t(56) = -3.95$, 95% CI -141.44–(-46.19), $p < .001$, $d = 1.05$; [f]$t(56) = -3.84$, 95% CI -213.10–(-67.07), $p < .001$, $d = 1.01$; [g]$t(56) = -3.38$, 95% CI -201.47–(-51.52), $p = .001$, $d = 0.88$.

Table 2 contains descriptive statistics for the ratings of SEB problems and competencies (BITSEA) for the whole group of children and separately for boys and girls at age 18 months. Boys tended to get higher Problem Total, externalizing, internalizing, and dysregulation domain scores, and girls tended to have higher Competence Total scores than boys, but these differences were not statistically significant.

TABLE 2. Descriptive statistics for BITSEA at 18 months

BITSEA	All (N = 58) Mean (SD) Median Range	Boys (n = 28) Mean (SD) Median Range	Girls (n = 30) Mean (SD) Median Range
Problem Total[a]	7.71 (4.34) 7 0–22	8.54 (4.39) 8 1–22	6.93 (4.22) 6 0–18
Externalizing[b]	2.60 (1.99) 2 0–9	3.04 (2.35) 3 0–9	2.20 (1.52) 2 0–6
Internalizing[c]	1.21 (1.12) 1 0–5	1.25 (1.18) 1 0–5	1.17 (1.09) 1 0–3
Dysregulation[d]	2.52 (1.85) 2 0–8	2.75 (1.56) 3 0–6	2.30 (2.09) 2 0–8
Competence Total[e]	16.91 (3.11) 17 8–22	16.14 (3.51) 17 8–22	17.63 (2.53) 18 12–22

Note. Student's t-test for two independent samples was used.

Significance of the difference between the scores in the groups of boys and girls: [a]$t(56) = 1.42$, 95% CI -0.66–3.87, $p = .162$, [b]$t(56) = 1.62$, 95% CI -0.20–1.87, $p = .111$; [c]$t(56) = 0.28$, 95% CI -0.51–0.68, $p = .780$; [d]$t(56) = 0.93$, 95% CI -0.52–1.42, $p = .358$; [e]$t(56) = -1.86$, 95% CI -3.09–0.11, $p = .068$.

3.2 Relationships between vocabulary, prelinguistic communication skills and SEB problems and competencies at 18 months

To assess the concurrent relationships between the children's vocabulary (MCDI), prelinguistic communication skills (ITC), and SEB problems and competencies (BITSEA) at the age of 18 months, Pearson product-moment correlations as well as partial correlations were used. In the partial correlations, child gender was controlled. The results can be seen in Table 3.

TABLE 3. Pearson product-moment correlations and *partial correlations*, controlling for child gender, between vocabulary (MCDI) and prelinguistic communication skills (ITC), and BITSEA scores at 18 months. P-values are in parentheses.

		ITC			
BITSEA	MCDI	Total	Social	Speech	Symbolic
Problem Total	-0.31 (.019)	-0.36 (.005)	-0.16 (.223)	-0.28 (.036)	-0.34 (.009)
	-0.25 (.058)	*-0.29 (.027)*	*-0.41 (.297)*	*-0.22 (.099)*	*-0.31 (.021)*
Externalizing	-0.32 (.014)	-0.36 (.006)	-0.19 (.155)	-0.29 (.027)	-0.33 (.012)
	-0.26 (.053)	*-0.30 (.024)*	*-0.17 (.219)*	*-0.23 (.091)*	*-0.29 (.028)*
Internalizing	-0.06 (.680)	-0.12 (.353)	-0.03 (.834)	-0.07 (.615)	-0.14 (.299)
	0.08 (.542)	*-0.10 (.474)*	*-0.02 (.864)*	*-0.06 (.675)*	*-0.13 (.321)*
Dysregulation	-0.20 (.125)	-0.188 (.157)	-0.01 (.935)	-0.13 (.329)	-0.22 (.104)
	-0.17 (.215)	*-0.11 (.400)*	*0.01 (.965)*	*-0.09 (.523)*	*-0.19 (.152)*
Competence	0.36 (.006)	0.73 (< .001)	0.60 (< .001)	0.46 (< .001)	0.65 (< .001)
Total	*0.28 (.034)*	*0.70 (<.001)*	*0.59 (<.001)*	*0.41 (<.001)*	*0.63 (<.001)*

Statistically significant correlations were found between MCDI vocabulary, ITC Total and all ITC Composite scores and SEB Competence score at 18 months. All these correlations remained significant when accounted for gender. By contrast, negative correlations were found between MCDI vocabulary score, ITC Total, Speech and Symbolic Composite scores and both SEB Problem Total and externalizing problem scores. Correlations with regard to ITC Total and Symbolic scores and Problem Total and externalizing problems remained significant when accounting for gender.

Furthermore, we investigated correlations between ITC and MCDI scores at 18 months. Specifically, ITC Total and MCDI scores (r = 0.54, p <. 001) correlated positively with each other, as well as all three ITC Composites and MCDI: ITC Social and MCDI (r = 0.28, p = .036), ITC Speech and MCDI (r = 0.62, p < .001), and ITC Symbolic and MCDI (r = 0.35, p = .006).

3.3 Relationships between prelinguistic communication skills and subsequent vocabulary

Next, we analyzed the relationships between the measures of prelinguistic communication skills and subsequent vocabulary using Pearson product-moment correlations as well as partial correlations. In

the partial correlations that concerned child vocabulary at 24 months, child gender and vocabulary at 18 months were controlled. In the partial correlations that concerned child vocabulary at 30 months, also child vocabulary at 24 months was controlled. The results are shown in Table 4.

TABLE 4. Pearson product-moment correlations and *partial correlations*, controlling for child gender and earlier vocabulary, between prelinguistic communication skills (ITC) at 18 months and vocabulary (MCDI) at 24 and 30 months. P-values are in parentheses.

	MCDI	
ITC	24 months	30 months
Total	0.63 (< .001)	0.49 (< .001)
	0.42 (.001)	*0.11 (.428)*
Social	0.30 (.022)	0.29 (.028)
	0.16 (.247)	*0.11 (.411)*
Speech	0.74 (< .001)	0.63 (< .001)
	0.52 (<.001)	*0.17 (.206)*
Symbolic	0.42 (.001)	0.27 (.042)
	0.24 (.071)	*-0.09 (.513)*

The ITC Total, as well as all Composite scores (Social, Speech, and Symbolic) at 18 months correlated positively with vocabulary (MCDI) at ages 24 and 30 months before accounted for gender and earlier vocabulary. With regard to partial correlations, only the associations of ITC Total and Speech Composite at 18 months with vocabulary at 24 months remained significant. With regard to ITC scores at 18 months and child vocabulary at 30 months, none of the partial correlations was statistically significant.

3.4 Relationships between social-emotional/behavioral problems and competencies and subsequent vocabulary

Finally, possible relationships between the children's SEB problems and competencies (BITSEA) at 18 months and the measures of vocabulary (MCDI) at 24 and 30 months were investigated using Pearson product-moment correlations and partial correlations. In the partial correlations that concerned child vocabulary at 24 months, child gender and vocabulary at 18 months were controlled.

In the partial correlations that concerned child vocabulary at 30 months, also child vocabulary at 24 months was controlled. The results are shown in Table 5.

TABLE 5. Pearson product-moment correlations and *partial correlations*, controlling for child gender and earlier vocabulary, between BITSEA scores at 18 months and vocabulary (MCDI) at 24 and 30 months. P-values are in parentheses.

	MCDI	
BITSEA 18 months	24 months	30 months
Problem Total	-0.23 (.081)	-0.24 (.066)
	-0.06 (.645)	*-0.12 (.380)*
Externalizing	-0.34 (.010)	-0.38 (.004)
	-0.19 (.155)	*-0.09 (.536)*
Internalizing	0.01 (.946)	-0.04 (.775)
	-0.01 (.988)	*-0.19 (.177)*
Dysregulation	-0.06 (.660)	-0.01 (.936)
	0.03 (.829)	*-0.08 (.572)*
Competence Total	0.41 (.001)	0.33 (.012)
	0.26 (.052)	*-0.03 (.816)*

The Competence Total score at 18 months correlated with vocabulary at 24 and 30 months. By contrast, externalizing problems at 18 months correlated negatively with vocabulary at 24 and 30 months. Neither of these correlations remained statistically significant when accounted for gender and earlier vocabulary.

4. DISCUSSION

The aim of this longitudinal community-sample study of 58 healthy children was to explore whether there are correlations between vocabulary (MCDI; Fenson et al., 1994), prelinguistic skills (ITC of the CSBS; Wetherby & Prizant, 2002), and SEB problems and competencies (BITSEA; Briggs-Gowan & Carter, 2006) at the age of 18 months and subsequent vocabulary (MCDI) at the ages of 24 and 30 months. Parental reports about expressive vocabulary, prelinguistic skills and SEB

problems and competencies were gathered. In prelinguistic communication questionnaires, the Social, Symbolic, and Speech Composite and Total scores were calculated. In SEB questionnaires, the Problem Total, externalizing, internalizing, and dysregulation problem domain scores, as well as Competence Total scores, were calculated. Gender and previous vocabulary were controlled in the analyses.

In this study, girls had statistically significantly larger vocabularies than boys at the ages of 18, 24, and 30 months. The gender difference in expressive vocabulary is well evidenced in previous studies (Bavin et al., 2008; Eriksson et al., 2011; Fenson, et al. 1994; Galsworthy et al., 2000; Horwitz et al., 2003; Law et al., 2018; Reilly et al., 2007). Additionally, there was a statistically significant gender difference in prelinguistic communication skills. Girls had statistically significantly higher ITC Total and ITC Speech Composite (i.e. early sound and word production) scores than boys. In the Symbolic composite, which consisted of questions concerning speech understanding and object use, and in the Social Composite, which consisted of questions concerning emotions, eye contact, communication, and gestures, there were no differences between gender. Like in the case with expressive vocabulary, gender differences in prelinguistic skills have been evidenced in previous studies (Eriksson et al., 2011; Fenson et al., 1994; Reilly et al., 2007). The reasons for the gender difference in early sound and word production and vocabulary have been thought to be due to interactions among biological, psychological, and social variables (Bornstein et al., 2010). Contrary to prelinguistic communication and language skills, there were no statistically significant differences between gender in any of the SEB measures at 18 months. These results are similar to many previous studies, which found no statistically significant differences between gender in SEB measures (Baillargeon et al., 2011; Beernink et al., 2007; Briggs-Gowan et al., 2001; Briggs-Gowan et al., 2006; Lavigne et al., 1998; Rescorla, & Achenbach, 2002, Skovgaard et al., 2007), but there is also contradictory evidence (Briggs-Gowan et al., 2001; Squires et al., 2001; Briggs-Gowan et al., 2004; Coie & Dodge, 1998; Rubin et al., 2003). In summary, gender role has important implications in screening for early prelinguistic and vocabulary skills. Even if it is not shown in the present study, based on some earlier investigations, gender is also an important consideration with regard to SEB problems and competencies.

In the present study, the relations between prelinguistic communication skills and SEB problems and competencies at 18 months were investigated, which to our knowledge, have not been studied before. In the present study, ITC Total score and all the ITC Composite scores correlated positively with SEB Competence score at the age of 18 months, also when accounted for gender. By contrast, ITC Total

and Symbolic and Speech Composite scores correlated negatively with BITSEA Total Problem and externalizing problem score. When accounted for gender, correlations with regard to ITC Total and Symbolic Composite and externalizing problems and BITSEA Total problems remained significant. Specifically, gender affected the relation between ITC Speech Composite and BITSEA Total and externalizing problem scores. As mentioned earlier, girls had statistically significantly larger expressive vocabularies than boys at the age of 18 months, and the effect size for the difference was large. Furthermore, vocabulary correlated positively with SEB Competence score at 18 months, also when accounted for gender. Conversely, vocabulary correlated negatively with SEB Problem Total and externalizing problem score, but not when gender was controlled. Our findings about the positive correlations between vocabulary and SEB Competence (Horwitz et al., 2003; Thurm et al., 2018), and negative correlations between vocabulary and SEB Total and externalizing problems (Horwitz et al., 2003; Manning et al., 2019; Thurm et al, 2018) are in accordance with previous studies. Some of these studies also suggested that between 18 and 24 to 29 months of age, language and social competence have the strongest relations (Horwitz et al., 2003; Thurm et al., 2018). Thurm and her group (2018) reported social competence at 18 and 24 months to be the only aspect of SEB problems and competencies in a clinical concern rate in the language delayed group of children.

We also investigated the relationship between prelinguistic communication measures at 18 months and expressive vocabulary at 24 and 30 months. As expected, all ITC prelinguistic communication measures at the age of 18 months had statistically significant correlations with subsequent MCDI vocabulary measures at 24 and 30 months. By contrast, only ITC Total and Speech Composite score at 18 months and vocabulary score at 24 months correlations remained statistically significant when accounted for gender and earlier vocabulary. Thus, gender and previous vocabulary affected the relations between ITC Social and Symbolic Composites at 18 months and vocabulary at 24 months. Furthermore, when accounted for gender and earlier vocabulary, none of the ITC scores at 18 months correlated with vocabulary at 30 months. Earlier vocabulary and gender affect subsequent vocabulary increasingly with age. In previous studies, prelinguistic communication skills have predicted later vocabulary (Ben-Sasson & Gill, 2014; Bruce, Kornfalt, Radeborg, Hansson & Nettelbladt, 2003; Fenson et al., 1994; Laakso et al., 1999; Wetherby, et al., 2003). Conversely, when investigating the different ITC prelinguistic composites, the Social Composite of the ITC has not correlated with vocabulary at 2 years of age (Vehkavuori & Stolt, 2018). In the present study as well, the correlation coefficients between the Social Composite and vocabulary were the weakest.

Next, we analyzed the relationship between SEB problems and competencies at 18 months and expressive vocabulary at 24 and 30 months. The largest positive correlation coefficients were found between BITSEA Competence score and subsequent vocabulary at 24 and 30 months, before accounted for gender and earlier vocabulary. By contrast, BITSEA Problem Total and externalizing problem score correlated negatively with subsequent vocabulary, before accounted for gender and earlier vocabulary. Our findings are similar to Horwitz and her group's (2003) and Thurm and her group's (2018) study, who evidenced negative correlations between expressive language and low social competence at the ages of 18 and 24 and also 29 months. Both groups used BITSEA when measuring SEB problems and competencies. Also, Irwin and her group (2002) found a correlation between language and social competence at the age of 27 months and Briggs-Gowan and Carter (2006) evidenced lower competence domain scores in a language delayed group between the ages of 12 and 35 months. Also, the negative relations between expressive language and externalizing problems between 12 and 38 months have been revealed in previous studies (Horwitz et al., 2003; Manning et al., 2019; Sim et al., 2012; Thurm et al., 2018; Whitehouse et al., 2011), and the strength of the association seems to increase with age between the ages of 12 and 38 months (Manning et al., 2019). Specifically, Horwitz and her group (2003) evidenced externalizing behavior problems to correlate with expressive language by the age of 30 months. Instead, earlier between the ages of 18 and 29 months, they found associations between low social competence and expressive language. Furthermore, Thurm and her group (2018) suggested, that the relation between language and later behavior problems may be mediated through poor social competence. Both Thurm and her group (2018) and Horwitz and her group (2003) pondered, that low-quality interactions with family and peers, and difficulties in making one's needs known, might result in later behavioral problems in children with language delays.

To summarize, there were seven early correlates at the age of 18 months for later vocabulary: the ITC Total score and the ITC Social, Speech and Symbolic Composites as well as the BITSEA Social Competence, Total Problem and externalizing problem scores. When accounted for gender and earlier vocabulary, only the ITC Speech Composite and ITC Total score correlated with vocabulary at 24 months. Thus, as early as at the age of 18 months, when children use very limited amounts of language, the interrelations between vocabulary, prelinguistic skills and SEB problems and competencies are discoverable. Although, even at this early age, previous vocabulary and gender affect the relations between vocabulary, prelinguistic skills and SEB problems and competencies substantially. The present study cannot identify causal links between vocabulary, prelinguistic skills and SEB problems and competencies. The links between language and SEB problems and

competencies are thought to have several, probably complex interacting causes (Johnson et al., 1999; Sim et al., 2013). Language problems may cause SEB problems, or SEB problems may interfere with language learning. In addition, there has been discussion about a common underlying cause such as brain development or hormones, or a common environmental factor accelerating both problems, such as parental interaction.

The sample size in this study was relatively small, and these results may not be applicable to other populations. Parents in our Finnish sample were educated above average and population based, so neither low socioeconomic status nor clinical sample gathering explained the connection between prelinguistic communication skills, vocabulary, and SEB problems and competencies. The effect sizes between vocabulary and SEB problems and competencies have been small in many previous studies, which could imply that the processes involved are multiply determined. Furthermore, with regard to interpreting the findings of the correlations between prelinguistic communication skills and SEB competencies, it is important to note that symbolic and social skills in ITC of the CSBS are operationalized partly the same way as SEB competencies in BITSEA. In both questionnaires, there are questions about pointing, looking when called by name, and hugging or feeding dolls or teddies. Additionally, shared method variance may affect the results, as all measures were parental questionnaires. Furthermore, while most of the Cronbach's alphas for ITC and BITSEA scores were adequate or marginal, for ITC Symbolic Composite and BITSEA internalizing and dysregulation problem domain scores, the alphas were poor. The low alphas may be partly due to the low base rate of occurrence of some item scorings among our sample. Additionally, in ITC Composites and BITSEA externalizing, internalizing, and dysregulation domains, there are only a few items, and therefore internal consistency for these domains could not be expected to be very high.

Regardless of the above-mentioned constraints, the present study provided additional information on the relationship between vocabulary, prelinguistic communication skills, and SEB problems and competencies. We investigated three early abilities of 18-month-old children: early vocabulary, prelinguistic communication skills, and rarely monitored SEB problems and competencies, their interrelations, and their correlations with later vocabulary skills. The screening methods used in this study are relatively easy, feasible, and cost-effective to administer in clinical practice. The ITC of the CSBS can be administered from 6 months, the MCDI from 8 months, and BITSEA from 12 months on. Even though early screening is difficult, late talkers should be screened beyond vocabulary measures only for their prelinguistic communication skills, as well as for SEB problems and competencies, to enhance the prognosis for language and communication skills and SEB problems

and competencies. By addressing social-emotional and prelinguistic communication skills, in addition to early vocabulary, there could be a year's advantage in early intervention. Furthermore, it has been suggested that there is only a narrow window of opportunity to alter the course from chronic behavioral and language disorder toward behavioral and language competence (Benner et al., 2002). Thus, early intervention might alter the trajectory of the child's development, enhance the family's quality of life, and exponentially decrease lifetime costs of intervention. Early identification of the most vulnerable children and providing early intervention by, for example, teaching intervention strategies to parents, could be helpful in addressing both language and SEB problems (Law & Plunkett, 2009; Roberts & Kaiser, 2011). Further research with larger sample sizes and more repeated bidirectional measurements between early language and prelinguistic skills and SEB problems and competencies is needed to understand more about the natural history of both language delay and SEB problems and competencies, and about the children most in need of intervention before negative cascading effects emerge.

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