Journal of Child Language (2025), **52**, 42–62
doi:10.1017/S0305000923000478

CAMBRIDGE UNIVERSITY PRESS

ARTICLE

Socio-economic status and other potential risk factors for language development in the first year of life

Sarah J. DER NEDERLANDEN[1], Jeannette C. SCHAEFFER[1], Hedwig H. J. A. VAN BAKEL[2] and Evelien DIRKS[3,4]

[1]University of Amsterdam, the Netherlands
[2]Tilburg University, the Netherlands
[3]Department of Psychology, Utrecht University, the Netherlands
[4]NSDSK, the Netherlands
Corresponding author: Evelien Dirks; Email: e.dirks@uu.nl

(Received 01 December 2021; revised 26 May 2023; accepted 20 June 2023)

Abstract
A wide variety of language skills has been shown to be compromised in children from low socioeconomic status (SES). However, few studies have investigated the effect of SES on language development in infants. The aim of this study is two-fold: to investigate when the first SES-effects on language can be observed and to explore the effects of three variables often claimed to be linked to SES – gestational duration, stress and parent-child interaction – on language development. Parents/caregivers of 539 Dutch-acquiring infants aged 8-13 months from mid to high SES backgrounds completed a questionnaire including the LENA Developmental Snapshot (Gilkerson et al., 2017a) and the Brigance Parent-Child Interaction Scale (Glascoe & Brigance, 2002). No association was found between SES and language development. However, the results suggest that corrected age and parent-child interaction positively influence language development at this early age.

Keywords: socio-economic status; infant language development; gestational age; Parent-child interaction; (Non-)Structural language

Introduction

Socioeconomic status (SES) is a multidimensional construct that refers to one's access to financial, social and educational resources (Duncan et al., 2015). Although there exist many ways to measure SES, the most common variables used by contemporary research are parental education, family income and parental occupation (Bradley & Corwyn, 2002). The negative developmental effects of growing up in lower SES environments have been well-studied. Low SES has been associated with a variety of adverse physical and mental health outcomes for children, as well as delayed cognitive development

(Perkins et al., 2013). Children from lower SES families consistently perform more poorly on measures of academic achievement, attention and executive control than their peers from higher SES families (Bradley & Corwyn, 2002; Farah et al., 2006; Stevens et al., 2009).

Negative effects of lower SES have also been demonstrated in multiple aspects of language, including vocabulary, phonology and syntax (Pace et al., 2017). By school entry, children from disadvantaged families perform well below their middle class peers on standardized tests of language production and comprehension (Ginsborg, 2006). Around the same age, low SES children produce only half the number of words their high SES peers produce (Hart & Risley, 1995). These early differences in language ability persist or even widen over time (Fernald et al., 2013; Walker et al., 1994).

As language ability in childhood has been identified as one of the best predictors of later academic success (Burchinal et al., 2016), understanding what causes the gap in linguistic performance between children from different socioeconomic backgrounds may be crucial for creating more equal opportunities at later stages in life. However, although SES-effects on language development have been subjected to intensive research over the past decades, a lot is still uncertain. One important question that remains to be answered is through which mechanisms SES affects language. Factors such as gestational duration, parent-child interaction and stress have been linked to both SES and language abilities. Therefore, multiple pathways exist through which SES-variables may influence language development. Furthermore, it is still unclear when SES starts affecting language development, as few studies have assessed the effects of SES on language abilities in children before age 1. The current study investigates infants' very early language development to provide new insights into both of these questions. In the next section, we provide a non-exhaustive overview of the empirical research on early SES-effects in the domains of gesturing, phonology and vocabulary. Then, possible explanations for the adverse effects of lower SES on language are discussed.

Gesturing

Gesturing can be considered a precursor as well as a predictor of language (Iverson & Goldin-Meadow, 2005; but see also Donnellan et al., 2020). In an effort to explain the disparities in vocabulary between children from low and high SES families, Rowe and Goldin-Meadow (2009) investigated whether differences in gesturing precede the vocabulary gap found at later age. The authors videotaped interactions between American-English children and their parents at the age of 14 months and analyzed the gesture types that were used. At this age, children from high SES families already use gestures to communicate more meanings than children from low SES families. The authors propose that this finding can be explained by parent gesture use, as high SES parents use more gesture types as well. To examine the effect of gesture skills on vocabulary development, children's vocabulary was assessed at 4;6 years. The results indicate that vocabularies of high SES children are significantly larger than those of low SES children. This effect of SES on vocabulary at 4;6 years is partially mediated by gesture use at 14 months.

A more recent study supports the idea that gesturing plays an important role in vocabulary development (McGillion et al., 2017). However, in this study, not low, but high SES was associated with delayed gesturing. Developmental synchrony in the onset of pointing, babbling and word production was assessed in British-English children through recordings at home from age 9-18 months. On average, children of more educated

https://doi.org/10.1017/S0305000923000478 Published online by Cambridge University Press

mothers started pointing later than children of lower educated mothers. The authors do not explain this finding. Furthermore, a vocabulary test indicated that receptive vocabulary at 18 months is associated with pointing and maternal education: children who started pointing early and who had higher educated mothers, also had higher vocabulary scores.

Phonology

Similar to gesturing, the earliest stages of phonological development already take place within the first year of life. For speech production, babbling can be considered the first developmental milestone. In the same study as described above, McGillion et al. (2017) found that the age at which children produce their first words is predicted by babble onset. However, no correlations were found between babbling onset and pointing onset or maternal education. Based on this finding, the authors conclude that babbling and pointing do not develop in tight synchrony. Furthermore, the authors propose that early phonological development plays a more important role in first word production than pointing.

These findings suggest that SES may affect pointing but not babbling onset. This hypothesis is supported by Eilers et al., who did not find an association between SES and onset of babbling either (Eilers et al., 1993). This study followed the early phonological development of preterm and full-term infants from different SES backgrounds during their first year of life. The authors found that neither prematurity nor SES predicts onset of babbling and propose that babbling onset is robust with regards to these risk factors.

However, the evidence on the effect of SES on babbling onset is mixed. Using a different measure of babbling, a recent study found that Flemish-Dutch children from low SES families start babbling significantly later than mid SES children (Vanormelingen et al., 2020). Interactions between children and their caregivers were recorded monthly between 6 and 24 months. Results show that with an average onset of 10 months, low SES children start babbling 3 to 4 months later than mid SES children.

Regarding speech perception, research on SES has predominantly focussed on phonological awareness. Phonological awareness – the sensitivity to the sound structures of words – has been shown to play an important role in literacy development (Catts & Kamhi, 1999). Multiple studies demonstrate that children from disadvantaged environments show lower levels of phonological awareness. For instance, in a large cross-sectional quantitative study, McDowell et al. (2007) found that children's phonological awareness is predicted by SES, vocabulary and speech sound accuracy. Children with high SES outperformed children with lower SES on both phonological awareness and vocabulary.

An effect of SES on phonological awareness has also been found in Chinese children (Zhang et al., 2013). Zhang et al. observed children longitudinally from ages 4 to 9 years old. Children were tested annually on a variety of tasks including different measures of phonological awareness, vocabulary and reading. The authors found that SES is strongly related to children's phonological, lexical and reading skills over time.

These studies provide strong evidence that phonological awareness is negatively affected by lower SES. However, studies on how SES affects other aspects of speech perception are scarce, even though some early phonological abilities may be critical for the development of other language skills, such as isolating and manipulating phonetic segments (Pennington et al., 1990). While phonological awareness skills do not develop before the preschool years (Carroll et al., 2003), by their first birthday, children have already learned phonetic properties of their native language (Gonzalez-Gomez et al., 2021). Two of the earliest signs infants are acquiring their native language are an increased ability to process native contrasts on the one hand and a decreased ability to process non-native contrasts on the other – a phenomenon known as perceptual narrowing (Werker & Tees, 1984).

A recent study sheds light on how SES affects perceptual narrowing in infants (Gonzalez-Gomez et al., 2021). Gonzalez-Gomez et al. investigated the effects of prematurity and SES on speech perception in British-English infants. Infants' prosodic, phonetic and phonotactic processing abilities were assessed at 7.5 9, 10.5 and 12 months of age. No significant differences were found between the prosodic development of high and low SES infants. However, results show that the phonetic and phonotactic development of low SES infants is delayed compared to high SES infants. At the age of 10.5 months, high SES infants are no longer able to discriminate contrasts from a non-native language. At the same age, high SES children start showing a preference for consonant-vowel-consonant pseudo-words with a high probability of occurrence in English. For low SES infants, both of these behaviors are not observed until the age of 12 months.

Another study found that not SES, but the quality of the home environment affects perceptual narrowing (Melvin et al., 2017). This study investigated the effects of SES, quantity and quality of the home environment on phonetic discrimination in American-English infants. The authors assessed phonetic discrimination, receptive and expressive language and quality of the home environment at 9 and 15 months. Controlling for expressive language skills at 9 months, the authors found a significant association between phonetic discrimination and quality of home environment, but not SES. Based on these results, the authors conclude that growing up in a linguistically rich home environment may be more critical for early language perception than SES, with potential implications for later language development.

Vocabulary

The effects of SES on children's vocabulary have been especially well-documented. Although McGillion et al. (2017) did not find an effect of SES on the age of first word production, Fernald et al. (2013) show that by 18 months, there is already a significant difference in the vocabulary processing efficiency between infants from low and high SES families. This study assessed the development of processing efficiency in relation to vocabulary in American-English infants from 18 to 24 months. By 24 months, the gap between low and high SES infants has widened to a 6 month difference.

In an influential study of the late 90's, Hart and Risley (1995) show that this gap continues to grow during early childhood. In this study, the authors analysed recordings of interactions between American-English children and their parents. Interactions were recorded for 1 hour every month over 2.5 years, starting at the age of 6 months. The authors found that by the age of three years, high SES children already produced twice as many words as their low SES peers.

Hoff (2003) supports the finding that SES affects expressive vocabulary. In this study, naturalistic interactions between mid to high SES mothers and their two-year-old children were examined. Interactions were recorded at two sessions that were 10 weeks apart. During these 10 weeks, the expressive vocabularies of the high SES children grew significantly more in size than those of the mid SES children.

Summary

Based on the empirical evidence described above, it is clear that lower SES is associated with a number of adverse effects on language development. However, findings are not always consistent. For gesturing – a domain that has not been studied much yet – previous studies suggest that infants from lower SES backgrounds use less diverse gestures, but start pointing earlier than their higher SES peers. As for phonology, while research on the relation between SES and phonological awareness has consistently demonstrated adverse effects of lower SES, findings on other phonological abilities are inconsistent. Mixed results have been reported for both babbling onset and perceptual narrowing – two of the earliest phonological skills to develop. The strongest evidence of SES-effects on language has been found in the domain of vocabulary. A vast range of studies has suggested that both the receptive and expressive vocabularies of low SES children are compromised compared to their higher SES peers.

Why does SES affect language?

A variety of environmental and behavioral explanations for SES-effects have been proposed in the literature. We will discuss three potential factors that have often been linked to SES in children older than 1.

Gestational duration

Even before birth, SES may affect a child's future linguistic development. Preterm birth – birth before 37 weeks gestation – is more common in mothers from low SES backgrounds (DeFranco et al., 2008). Prematurity has been associated with a number of anatomical differences in brain structure, such as decreased grey matter volumes and myelinated white matter (Hüppi et al., 1998). Being born preterm is associated with delayed neurocognitive development (Gleason et al., 2022). One might argue that while a full-term and a preterm child are both 0 weeks old at birth, the latter should be considered younger than the former, which would explain delayed development. This is why it can be helpful to look at corrected age – a child's chronological age minus the number of weeks they are preterm – instead of chronological age. However, even when considering corrected age instead of chronological age, some studies have found negative effects of prematurity on language development.

In a longitudinal study, Foster-Cohen et al. (2007) assess the language development of New Zealand children with a gestational duration of 33 weeks or less compared to that of children with a gestational duration of 38 to 41 weeks. Corrected for gestational duration at birth, at 2 years old, children's language development was assessed. Strong relationships were found between gestational age at birth and early language abilities, including vocabulary size, syntactic and morphological complexity and quality of word use.

This finding is supported by Cusson (2003), who examined the language development of American-English preterm infants with a gestational age of 36 weeks or less. General development and language were assessed at 7, 13 and 26 months. The results show that by 26 months of corrected age, while general development is within the normal range, language is delayed by 3 to 5 months. In line with the literature, both Foster-Cohen et al. (2007) and Cusson (2003) also demonstrate a significant relation between prematurity and SES.

https://doi.org/10.1017/S0305000923000478 Published online by Cambridge University Press

Even in full term infants – infants born between 37-41 weeks of gestation – gestational duration might affect cognitive development. The fetal brain does not stop developing at 37 weeks, but continues to undergo fundamental organizational changes throughout late gestation (Davis et al., 2011). While most research has focussed on the implications of prematurity on child development, Van Espel et al. (2014) explored the effect of longer gestation in full-term infants and found that longer gestation benefits both cognitive and motor development.

Parent-child interaction

The way that parents interact with their children has been shown to play an important role in development at all socioeconomic levels. Several studies suggest that the quantity and quality of parental speech is lower in low SES families. For instance, Hoff (2003) found that the SES-effect on children's expressive vocabulary is mediated by the length of parental utterances. Furthermore, Hart and Risley (1995) show that less educated parents were likely to use fewer words, fewer references to events that were not in the present and less complicated syntax. Lastly, a study on interactions between mothers and Dutch children from different SES backgrounds shows that the quantity and quality of mother-child interactions is lower for low SES families (Vanormelingen & Gillis, 2016). The authors found that low SES mothers produce fewer and shorter utterances per hour, take fewer turns per hour and respond significantly less to their children's utterances. It is worth noting that recent studies have challenged the idea that language input differs substantially between low and high SES (Dailey & Bergelson, 2022; Sperry et al., 2019). These studies suggest that differences may be more nuanced depending on the methodology used.

The reduced quality and quantity of input may explain some of the language problems of low SES children. Weisleder and Fernald (2013) show that the amount of speech directed to infants of low SES families affects children's vocabulary learning and language processing abilities. At 19 months old, interactions between Latin-American children and their parents were recorded during daily activities. At 2 years old, children's expressive vocabulary and language processing efficiency were measured. The amount child-directed speech at 19 months predicted expressive vocabulary size and language processing efficiency at 2 years, while this result was not found for speech that is not chid-directed.

Other studies suggest that the quality of language input influences language development. Rowe (2012) examined the quantity and quality of speech of American-English parents during interactions with their children. Parent-child interactions were recorded at home at child age 1;6, 2;6 and 3;6 years. Until the age of 4;6 years, children's vocabulary skills were measured annually. Consistent with Weisleder and Fernald (2013), Rowe found that quantity of parental speech is significantly related to children's vocabulary skills at 2;6, 3;6 and 4;6 years. However, at 3;6 years, lexical diversity and sophistication of parental speech is related to vocabulary skills as well. Furthermore, parents' use of decontextualized language (e.g., narratives and explanations) is related to vocabulary skills at 4;6 years. Based on these findings, Rowe suggests that while quantity of input is most important for vocabulary growth at toddler age, quality becomes more important at later ages.

Stress

Another mechanism through which SES may affect language development is stress. Low SES is associated with higher cortisol levels, which have adverse outcomes for physical health and development (O'Connor et al., 2021). Vliegenthart et al. investigated the effect of SES on chronic cortisol and cortisone levels in children and adolescents and found that individuals with low SES have chronically higher cortisol levels (Vliegenthart et al., 2016

Increased stress levels can affect language development in different ways. It has been shown that stress negatively impairs memory and executive functioning (EF) – two abilities that are tightly connected to language (Farah et al., 2006). Other studies have demonstrated a direct effect of stress on the language development of children. Farver et al. found that high maternal stress predicts significantly lower vocabulary scores in children (Farver et al., 2006). The authors suggest that stress may affect parents' capacity to provide a supportive environment for children's developing language abilities.

Noel et al. explored whether maternal stress can predict language skills in low SES children (Noel et al., 2008). Canadian-English children between 2 and 10 years old participated in a variety of tasks assessing expressive and receptive vocabulary and expressive narrative ability. Mothers of these children, who were all from low SES backgrounds, reported on their perceived stress levels. The results indicate that high maternal stress negatively affects children's receptive and expressive vocabulary.

Research questions and hypotheses

Although SES-effects on language are a well-recognized problem, not much is known yet about the mechanisms through which SES affects language and at what age SES starts to have an effect on language.

To uncover the pathways through which SES affects language development, it is necessary to identify when SES-effects on language start to emerge. As some of the studies discussed above have demonstrated, SES-effects on language are already observable at a very young age, the earliest reported effects being a delayed babbling onset at 6 months (Vanormelingen et al., 2020; but for studies who do not find such an effect, cf. McGillion et al., 2017; Eilers et al., 1993) and pointing onset at 12 months (McGillion et al., 2017). This suggests that the disparities between low and high SES children may already start to develop within the first year of life, although there is not much research on this yet.

The purpose of the current study is two-fold. First of all, we aim to provide new insights in when SES starts affecting language development. Secondly, we want to explore the effects of risk factors previously linked to SES on early language development. What distinguishes this study from previous studies is that it explores language development within the first year of life in a relatively large number of infants. This offers a unique opportunity to identify the start of the pathway through which SES affects language. Our specific research questions are as follows:

1. When do we observe the first effects of SES on language development?
2. What are the effects of gestational duration, parent-child interaction and stress on early language development?

Research question 1 is an open question. For research question 2, we hypothesize that gestational duration, parent-child interaction and stress all influence early language development.

Method

Participants

562 participants were drawn from the longitudinal Baby 2020 study by the NSDSK (Dutch Foundation for the Deaf and Hearing-impaired Child) and the Tilburg University on infants born around the first Covid-19 lockdown in the Netherlands and their parents. The present study reports on infant language development measured at 8 to 13 months. 286 of the infants were girls and 253 of the infants were firstborns. Reported nationalities of the parents were Dutch (98.1%), Belgian (0.56%), German (0.19%), Austrian (0.19%), Spanish (0.19%), Russian (0.19%), Serbian (0.19%), Australian (0.19%) and Chinese (0.19%). Families were recruited through advertisements on social media platforms and online forums for parents and flyers at well baby clinics. Among participants who completed the first questionnaire, instant cameras were raffled off. Participants who completed the second questionnaire had a chance of winning a gift of 25 euros or a small gift. All parents gave informed consent for participation in the study and the study was approved by the Ethical Review Board of Tilburg School of Social and Behavioral Sciences (RP 186). 34 participants were excluded because of missing or erroneous information.

Materials and procedure

Data were collected between June 2020 and May 2021. Parents filled out two online questionnaires at two different time points, using Qualtrics. When infants were between 0 and 6 months old, parents filled out the first questionnaire. Through this questionnaire, background information about the families was collected, including child gender, birth weight, pregnancy duration, parental education and nationality. Parental education and subjective financial security, which were used to measure SES, were collected through the first questionnaire as well.

The second questionnaire was filled out by parents when their children were between 8 and 13 months old. This questionnaire consisted of a number of smaller questionnaires assessing different aspects of child development and parent-child relations. This included the first 28 questions of the LENA developmental Snapshot: a 52-item, parental questionnaire designed to assess language development of children between 2 and 36 months of age (Gilkerson et al., 2017a; Dutch translation by Schaeffer et al., 2021). The 28th question was chosen as a cut-off point based on the age of the infants in this study. The second questionnaire also included the Brigance Parent-Child Interactions Scale, which assesses parenting behaviors and parents' perceptions towards their children (Glascoe & Brigance, 2002). Furthermore, participants were also asked about stressful life events and the impact of Covid-19 in this questionnaire.

SES

SES was measured through two variables: the level of education of the parent filling out the questionnaire and the subjective financial security of the family. To test the effect of parental education on early language development, parents were asked what the highest level of education is they have finished: no education (1), elementary school (2), preparatory secondary vocational education (3, 'vmbo' in Dutch), higher general secondary education/pre-university education (4, 'havo/vwo' in Dutch), post-secondary vocational education (5, 'mbo' in Dutch), university for applied sciences (6, 'hbo' in Dutch), university (7) or post-academic (8). To test the effect of subjective financial security on early language development, parents were asked to report to which extent they can make ends meet financially as a family: 'very poorly' (1), 'poorly' (2), 'sufficiently' (3), 'well' (4) or 'very well' (5).

Early language development

Early language development was scored by the total count of 'yes' responses on the first 28 questions of the LENA Developmental Snapshot. The Snapshot was created as a means for parents to easily and efficiently evaluate language development of young children. Unlike professional evaluations, the Snapshot provides an opportunity to assess language development in children's natural home environments on a regular basis, making it a valid and reliable measurement tool (Gilkerson et al., 2017a). Parents were instructed to answer questions about their child's behavior (e.g., 'does your child imitate sounds you or others make?') with 'yes' if they had consistently observed this behavior in the past and 'not yet' if not. The questions focus on early linguistic domains, such as vocal behavior, preverbal communication, responsiveness to instruction, spontaneous speech and vocabulary development. Several of the questions directly relate to the gesture, phonology and vocabulary abilities discussed in the previous section (e.g., "When you name different objects, does your child point to them?" relates gesture and "Does your child say any words besides "mama" or "dada"?" for vocabulary).

The questions of the Snapshot are ordered in estimated developmental sequence, beginning with skills observed at 2 months and progressing through the first year of life. To reduce the time needed for parents of younger children to fill in the questionnaire, a rule is usually adopted for parents to stop after five 'not yet' responses. As the current study used only the first 28 questions of the Snapshot, this rule was not used. Based on the number of positively answered questions, a score was calculated for all infants, referred to as the Snapshot score.

Gestational duration

With gestational duration we are referring to the number of weeks the pregnancy lasted.

Corrected age

Corrected age is an infant's chronological age in weeks minus/plus the number of weeks they were born before/after 40 weeks of gestation. For example, an infant with a chronological age of 50 weeks and a gestation of 35 weeks has a corrected age of 45 weeks.

Parent-child interaction

A selection of eight questions from the Brigance Parent-Child Interactions Scale (BPCIS) was used to test the effect of parent-child interaction (PCI) on early language development. The BPCIS is a multi-informant scale that uses parent self-reports and professional observation to assess the behaviors and perceptions of parents towards their children (Glascoe & Brigance, 2002). In the self-reports, parents are instructed to answer questions on a scale from 1 ((almost) never) to 5 ((almost) always). In the current study, a selection

https://doi.org/10.1017/S0305000923000478 Published online by Cambridge University Press

of questions relating to language behavior was made (e.g., 'I teach my child things by talking and showing him/her new things'; 'I look at or read children's books to my child').

Stress

To test the effect of parental stress on early language development, parents were asked whether or not a stressful life event has had an impact on their family in the past year. Four stressful life events were inquired about: loss of job, severe disease, divorce and stressful events categorized as 'other'.

Covid-19

As the data were collected during a unique time period – the beginning of the Covid-19 pandemic – we asked parents to which extent Covid-19 and the Covid-19 measures in the Netherlands have negatively impacted parenthood and their relationship with their child: no negative influence (1); some negative influence (2); negative influence (3); large negative influence (4) or very large negative influence (5).

Analysis

Statistical analyses were performed on Snapshot scores. R-software was used to create generalized linear regression models and correlation matrices (R version 4.0.2, packages 'tidyverse' and 'Hmisc'). Model comparisons were conducted to assess which variables are significant predictors of Snapshot score. $\chi 2$ tests (ANOVA) determined whether a model was a significant improvement of a null-model.

Results

Descriptive statistics for the dependent and independent variables of this study are presented in Table 1. The next section explores the relation between general infant characteristics and Snapshot scores. Then, we present regression models that test how SES variables relate to Snapshot scores. Lastly, we explore the relations between Snapshot scores and three SES-related factors: gestational duration, stress and parent-child interaction.

Table 1. Descriptive statistics

	Min	Max	Med	SD
Chronological age in weeks	35	60	48	4.281
Gestational duration in weeks	26	44	40	1.785
Snapshot scores	7	28	14	3.068
Parental education scores	3	8	6	0.986
Financial security scores	1	5	4	0.649
PCI scores	19	35	28	3.037

N = 539.

https://doi.org/10.1017/S0305000923000478 Published online by Cambridge University Press

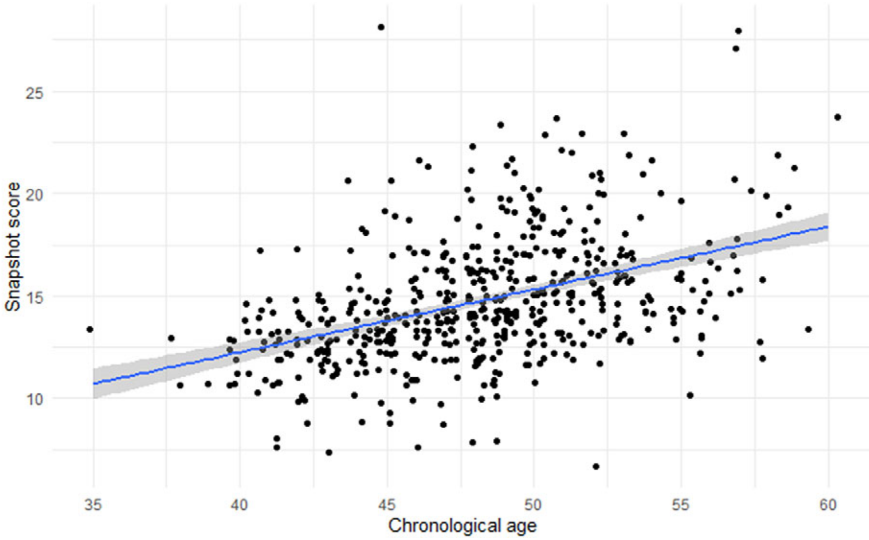

Figure 1. Snapshot scores as a function of chronological age in weeks.

General infant characteristics

A moderate positive correlation between chronological age and Snapshot scores demonstrates the validity of the Snapshot as an accurate measure of language development, $r(537) = .46$, $p = <.001$, see Figure 1. A similar, but numerically higher correlation exists between corrected age and Snapshot scores $r(537) = .49$, $p = <.001$. A one-way ANOVA test shows that there were no significant differences between the Snapshot scores of boys and girls in this study, $F(1, 537) = 1.302$, $p > .05$, nor between the Snapshot scores of firstborns and later-borns, $F(1, 538) = 2.467$, $p > .05$.

SES

There was a small positive correlation between parental education and financial security, $r(537) = .26$, $p = <.001$. Parental education and subjective financial security were used to construct generalized linear regression models predicting Snapshot score (Table 2). Model comparison shows that a model using corrected age, parental education and

Table 2. Regression model fitting corrected age, parental education and financial security to Snapshot score

	Estimate	Standard error	Z-value	p
Intercept	1.806	0.147	12.290	<.001 ***
Corrected age	0.020	0.002	8.305	<.001***
Parental education	−0.016	0.011	−1.367	.172
Financial security	−0.003	0.018	−0.144	.886

N = 539. *p < .05. **p < .01. ***p <.001

https://doi.org/10.1017/S0305000923000478 Published online by Cambridge University Press

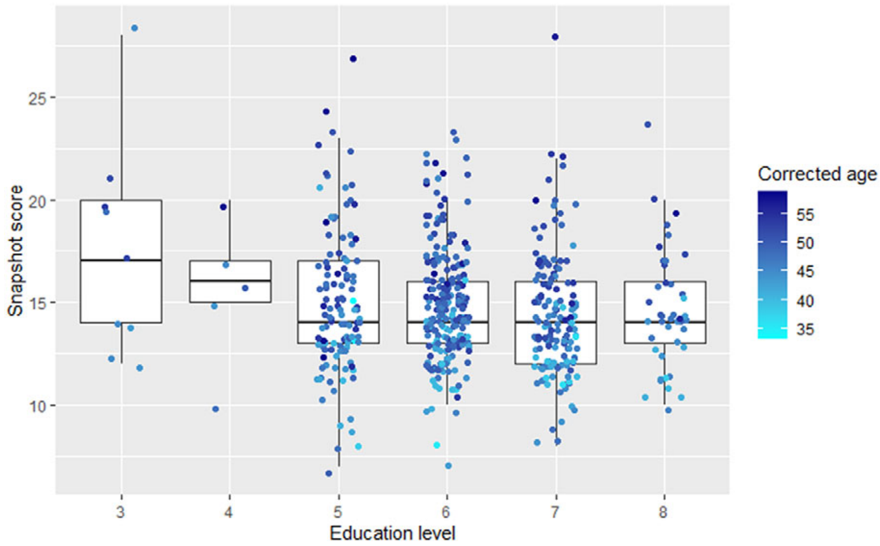

Figure 2. Snapshot scores at different education levels for different ages.

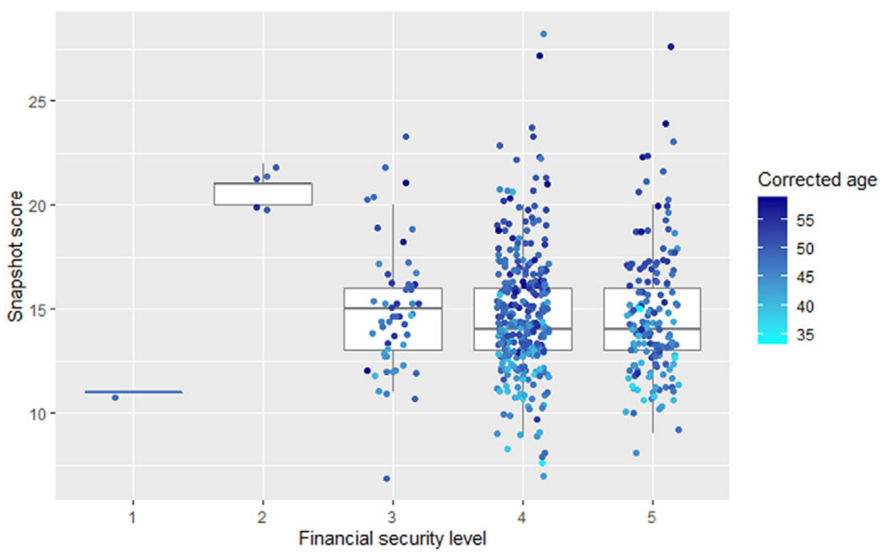

Figure 3. Snapshot scores at different financial security levels for different ages.

financial security as independent variables is not significantly better at predicting Snapshot scores than a model using only corrected age as an independent variable, X^2 (2, N = 539) = 2.123, p >.05. This indicates that parental education and financial security do not predict Snapshot scores. In Figure 2 and 3 the Snapshot scores for respectively different education levels and financial security levels for different ages are presented.

https://doi.org/10.1017/S0305000923000478 Published online by Cambridge University Press

Table 3. Regression model fitting gestational duration and corrected age to Snapshot score

	Estimate	Standard error	Z-value	p
Intercept	1.766	0.259	6.824	<.001 ***
Gestational duration	−.0.002	0.007	−0.214	.83
Corrected age	0.021	0.003	7.884	<.001***

N = 539. *p < .05. **p < .01. ***p <.001

Gestational duration

In Figure 4 the Snapshot score as a function of gestational duration is presented. A small positive correlation was found between gestational duration and Snapshot scores, $r(537) = .17$, $p = <.001$. When controlling for corrected age, however, this correlation disappears. Model comparison shows that a regression model using gestational duration and corrected age as independent variables is not better at predicting Snapshot scores than a model using corrected age alone, X^2 (1, $N = 539$) = 0.213, $p > .05$ (Table 3). This demonstrates that corrected age and not gestational duration is a good predictor of Snapshot scores. There was a small positive correlation between gestational duration and related parental education, $r(537) = .11$, $p = <.05$, and no correlation between gestational duration and financial security, $r(537) = .00$, $p = >.05$.

Parent-child interaction

A moderate positive correlation was found between PCI scores and Snapshot scores, $r(537) = .25$, $p = <.001$. A regression model using PCI scores and corrected age as independent variables was built to predict Snapshot scores (Table 4). Model comparison shows that this model is better at predicting Snapshot scores than a model using corrected

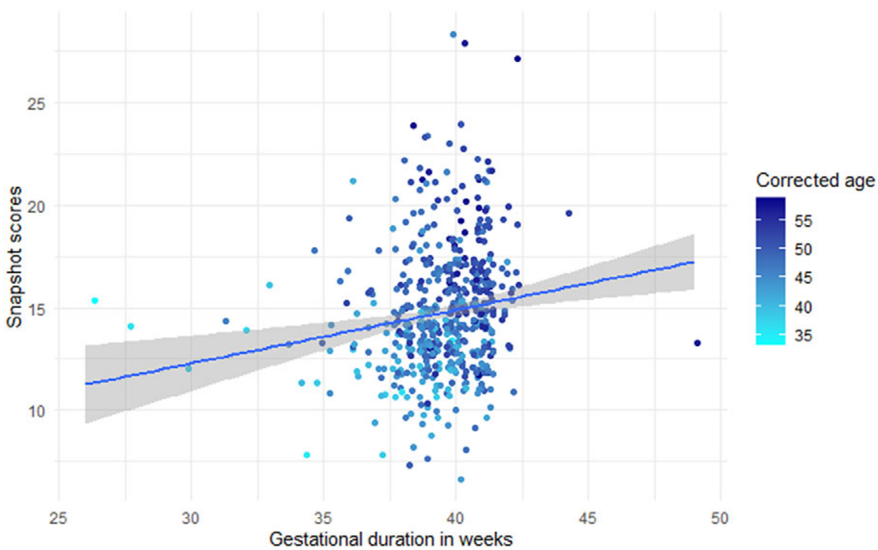

Figure 4. Snapshot score as a function of gestational duration.

https://doi.org/10.1017/S0305000923000478 Published online by Cambridge University Press

Table 4. Regression model fitting corrected age and PCI score to Snapshot score

	Estimate	Standard error	Z-value	p
Intercept	1.337	0.151	8.823	<.001 ***
Corrected age	0.014	0.004	3.914	<.001***
PCI score	0.012	0.002	8.122	<.001***

N = 539. *p < .05. **p < .01. ***p <.001

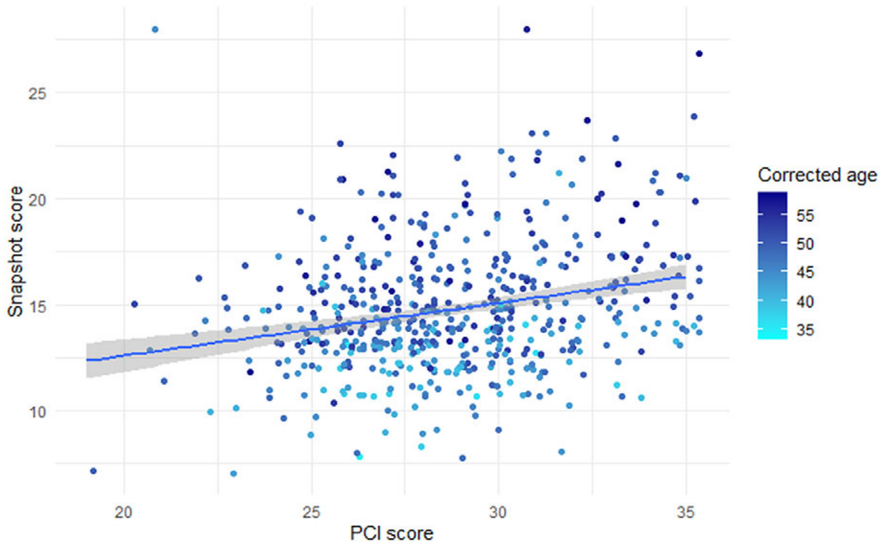

Figure 5. Snapshot score as a function of PCI score.

age alone, X^2 (1, N = 539) = 15.307, p <.001. This indicates that PCI scores are a significant predictor of Snapshot scores, see Figure 5. PCI scores were not correlated with parental education, $r(537) = .03$, p = >.05. However, there was a small positive correlation between PCI scores and financial security, $r(537) = .09$, p = <.05.

Stress

Out of all 539 participants, 2 experienced divorce, 49 experienced disease, 42 experienced job loss and 144 experienced other stressful life events in the past year. There were no correlations between Snapshot scores and divorce $r(537) = .00$, p = > .05, disease .07, p = > .05 or job loss .02, p = > .05. The only stressful life events correlated with Snapshot scores are those categorized as 'other'. This correlation is positive, indicating that these life events have a positive influence on Snapshot scores. However, the correlation is small. Stressful life events categorized as 'other' were not correlated with parental education $r(537) = -.06$, p = >.05, nor with financial security, $r(537) = -.07$, p = >.05.

https://doi.org/10.1017/S0305000923000478 Published online by Cambridge University Press

Covid-19

Out of all participants, 60.3% answered 1 (no negative influence); 34.1% answered 2 (some negative influence); 4.3% answered 3 (negative influence); 0.74% answered 4 (large negative influence) and 0.6% answered 5 (very large negative influence). Covid-19 responses were not correlated with Snapshot scores, $r(537) = .03$, $p = >.05$. However, there was a small negative correlation between Covid-19 responses and PCI scores, $r(537) = -.10$, $p = <.05$. As for stressful life events, there was a small positive correlation between Covid-19 responses and stressful life events categorized with other. Covid-19 responses were not correlated with parental education, $r(537) = -.08$, $p = >.05$, nor with financial security, $r(537) = -.07$, $p = >.05$.

Discussion

The current study aims to investigate the effects of SES on early language development. The scores on the LENA Developmental Snapshot of 539 8- to 13-month-olds from mid to high SES families were used to measure early language development of Dutch infants. The relation between two SES variables – parental education and financial security – and infants' language development were assessed. In addition, we explored how three factors related to SES – gestational duration, parent-child interaction and stress – affect language development.

This study found no evidence of an effect of the SES elements parental education or financial security on the language development of infants aged between 8 and 13 months old. However, in line with our hypothesis, corrected age and parent-child interaction did emerge as significant predictors of language abilities.

Multiple explanations can be proposed for the absence of an SES-effect in this study. The first possible explanation is methodological in nature. As shown in Table 1, very few parents had low education and financial security scores. According to the CBS – the Dutch central agency for statistics – only participants with a level 1, 2 or 3 on the education scale can be classified as having a low level of education (CBS, n.d.). According to this information, only 1.6% of the parents in this study has a low education level, while the actual percentage of Dutch 15- to 75-year-olds with a low education level is much higher: 28.3% in 2019 (Onderwijs in Cijfers, 2019). Similarly, the percentage of parents who indicated that their level of financial security was insufficient – level 1 or 2 on the financial security scale – was only 1.1%. In contrast, the percentage of the Dutch population living under the low-income threshold was 6.2% in 2019. These percentages demonstrate that this study underrepresents the Dutch low SES population. Nonetheless, our data do cover mid-to-high SES, and as such, have some variation. We therefore believe that our results are informative with respect to our research questions.

Secondly, it is possible that SES does not affect language development before the age of 13 months. Research on SES-effects in children this young is scarce and the findings are mixed (e.g., Eilers et al., 1993; Gonzalez-Gomez et al., 2021; McGillion et al., 2017; Vanormelingen et al., 2020). While a vast body of evidence suggests that SES already affects language development by the time children enter elementary school (Fernald et al., 2013; Hart & Risley, 1995; Hoff, 2003; McDowell et al., 2007; Zhang et al., 2013), these effects may not be observable or even present before the age of 13 months. This hypothesis is in line with recent research suggesting that variability in language development does not occur until later in life. In an effort to characterize children's language environment, Gilkerson et al. made daylong recordings of interactions between children aged 2-48

https://doi.org/10.1017/S0305000923000478 Published online by Cambridge University Press

months and their caregivers (Gilkerson et al., 2017b). These recordings showed that the variability of vocalization frequency is very small during the first year of life, but becomes much larger after this period. Based on this, the authors surmised that in younger children, environmental factors – including SES – may not have as much influence as in older children.

Alternatively, SES may not affect language development of Dutch children to the same degree as children from other countries. A large proportion of the research on SES and language development has been conducted in the United States. This includes studies that have found some of the strongest evidence of SES-effects (e.g., Fernald et al., 2013; Hart & Risley, 1995; Hoff, 2003). Differences in SES are arguably less pronounced in the Netherlands compared to the United States, as the social inequality gap is smaller in the former (OECD Better Life Index, 2016). Consequently, it is possible that growing up in a relatively low SES environment in the Netherlands does not lead to the same negative outcomes as in the United States. We believe that more cross-cultural work is necessary for scientific progress on this topic. As language learning is culturally defined, researchers should not trust that all findings from the US generalize to other countries.

Finally, SES-effects in children this young may be too fragile to be detected by our measure of language development. It is possible that SES-effects observed in older children are the result of an accumulation of early life experiences. We would like to stress that the absence of an SES-effect in our study should not be interpreted as evidence that SES is irrelevant for language development in the first year of life. We believe that support during the first year of life may be necessary for low SES children to mitigate adverse effects on language development observed later in life.

As for factors that have been linked to SES in previous studies, we found that gestational duration, parent-child interaction and stress are related to language development, although not all in the way we expected. In line with previous research indicating that shortened gestation negatively affects language development (Cusson, 2003; Foster-Cohen et al., 2007), we found that language abilities increase with gestational duration. However, contrary to these studies, no effect of gestational duration is found when controlling for corrected age. This indicates that corrected age is actually a significant predictor of language abilities and no additional effect of gestational duration can be distinguished. Furthermore, in line with DeFranco et al. (2008), the current study found a small positive correlation between gestational duration and parental education. In contrast to this study, we did not find a correlation with financial security.

Parent-child interaction, as measured by a selection of language-related questions (e.g., questions about storybook reading and songs) of the Brigance Parent-Child Interactions Scale, also emerged as a significant predictor of language abilities. This finding is consistent with previous research suggesting that the quantity and quality of child-directed speech affects language development (Hoff, 2003; Rowe, 2012; Weisleder & Fernald, 2013). While parental education was not correlated with PCI scores in the current study, financial security was. Other studies have suggested that the quality and quantity of parent-child interaction is reduced in financially disadvantaged families (Hart & Risley, 1995; Vanormelingen & Gillis, 2016). A more in depth exploration of the relation between financial concerns and parent-child interaction can be found in a recent work by Ellwood-Lowe et al. (2022), who found evidence that financial scarcity suppresses caregivers' speech to their children.

Nevertheless, note that the studies demonstrating effects of parent-child interaction on language development mentioned here were conducted with children older than 1. It remains a question whether reduced parent-child interaction in the very early stages of life

https://doi.org/10.1017/S0305000923000478 Published online by Cambridge University Press

has an effect on later language development. Gilkerson et al. (2018) report that turn-taking, which could be considered an instantiation of parent-child interaction, between 18 and 24 months predicts school-age language outcomes, but turn-taking before 18 months does not. This suggests that parent-child interactions may influence language abilities in the earliest developmental stages, as the current study shows, but that they may not be predictive of later language development. If parent-child interaction is related to SES (Hart & Risley, 1995; Hoff, 2003; Vanormelingen & Gillis, 2016), this may mean that SES in early life is not predictive of later language abilities either, but only becomes relevant after the first year of life. Future studies on these issues are clearly needed.

Stressful life events did not negatively affect infants' language abilities. However, there was actually a small positive correlation between stressful events categorized as 'other' and language abilities. It is difficult to explain this finding without knowing the exact nature of these events. Based on this, there is no evidence to support our hypothesis that stress negatively affects early language development. It must be noted here that with only 4 categories of stressful events, the questionnaire used in this study to measure the effect of stress is rather superficial. Moreover, stressful life events are not the only possible source of stress. A more in-depth questionnaire is needed to fully explore how stress influences early language development.

As a final remark, it is worth mentioning that the infants in this study were born during an extraordinary time, as the outbreak of the Covid-19 virus had just resulted in a national lockdown in the Netherlands. Like for most countries, the pandemic strongly affected the daily lives of Dutch citizens. Needless to say, it was a stressful time for most people. As maternal stress has been linked to compromised language skills in children (Farver et al., 2006; Noel et al., 2008), the Covid-19 pandemic may negatively affect the language development of infants born during this time. However, based on parents' self-reports, the negative impact of the pandemic on parenting and consequently children's language development seems to be limited.

We found no relation between parents' perceived negative impact of Covid-19 on their parenting and children's language abilities. A possible explanation for these results may be that most parents were forced to work from home during this time period, which potentially increased the opportunity to spend time together with their children.

We did find a small negative correlation between parents' perceived impact of Covid-19 on parenting and PCI scores. This result is not surprising, as parents who reported great negative influence of Covid-19 on their relationship with their child were probably less likely to interact with their child. Although the proportion of parents whose parenting was greatly affected by the pandemic was relatively small, this finding is still disconcerting. After all, parent-child interaction does not play an important role for language development alone, but for many other aspects of child development as well.

Although the context of the study limits the generalisability of our results, one could also argue that it emphasizes the importance of PCI for language development, as the relationship between the two remains stable even under exceptional circumstances. An interesting suggestion for future research would be to compare the performance on the LENA Developmental Snapshot of the infants in the current study to that of infants born after the pandemic.

Another direction for future research is to explore SES-effects in individual language domains. Similar to SES, language is a multidimensional construct. Therefore, it is possible that SES affects some but not all language abilities. This could, however, in turn have cascading effects on the development of other linguistic and non-linguistic skills.

Further work is needed to untangle the pathways of risk factors for language development associated with SES.

Conclusion

The purpose of this study was two-fold: to investigate the effect of SES on early language development and to assess the effects of three factors related to SES on language development. No effects of the SES elements parental education or financial security were found on language development before the age of 13 months in our sample of mostly mid to high SES infants. As for factors that have been linked to SES in previous studies, corrected age and parent-child interaction were found to predict early language development. While not related to parental education or financial security in this study, previous research has linked both of these factors to SES. Stressful life events were not related to language outcomes, except for those categorized as 'other', which had a small positive correlation with language score. Gestational duration positively influenced language development, but not when controlling for corrected age. This demonstrates that corrected age is a more accurate predictor of early language development than gestational duration.

The most important finding of this study is the positive effect of parent-child interaction on early language development. While previous studies already revealed that parent-child interaction influences language development, the current study suggests that this effect can already be observed at a very young age, within the first 13 months of life. Future studies need to show whether parent-child interaction before the age of 13 months has a lasting effect on later language abilities.

Acknowledgements. We thank the LENA Foundation, and in particular, Jill Gilkerson and Steve Hannon for sharing the English version of the LENA Snapshot with us and allowing us to translate it to Dutch. We are very grateful to Jill Gilkerson for her time to discuss translation issues with us and for her valuable feedback on this paper. We also thank Jeff Richards for his help in deciding the cut-off point in the LENA Snapshot questions for the population in the current study.

Competing interest. The author(s) declare none.

References

Bradley, R. H., & **Corwyn, R. F.** (2002). Socioeconomic status and child development. *Annual review of psychology* **53**, 371–399. DOI: 10.1146/annurev.psych.53.100901.135233

Burchinal, M. R., **Pace, A.**, **Alper, R.**, **Hirsh-Pasek, K.**, & **Golinkoff, R. M.** (2016). Early language outshines other predictors of academic and social trajectories in elementary school. Presented at Assoc. Child. Fam. Conf. (ACF), Washington, DC, July 11–13.

Carroll, J. M., **Snowling, M. J.**, **Hulme, C.**, & **Stevenson, J.** (2003). The Development of Phonological Awareness in Preschool Children. *Developmental Psychology* **39**(5), 913–923. DOI: 10.1037/0012-1649.39.5.913

Catts, H., & **Kamhi, H.** (Eds.). (1999). *Language and reading disabilities*. Needham Heights, MA: Allyn & Bacon.

CBS. (n.d.) *Opleidingsniveau.* https://www.cbs.nl/nl-nl/nieuws/2019/33/verschil-levensverwachting-hoog-en-laagopgeleid-groeit/opleidingsniveau

Cusson, R. M. (2003). Factors influencing language development in preterm infants. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*, **32**, 402–409. DOI: 10.1177/0884217503253530

Dailey, S., & **Bergelson, E.** (2022). Language input to infants of different socioeconomic statuses: A quantitative meta-analysis. *Developmental science*, **25**(3), e13192. https://doi.org/10.1111/desc.13192

Davis, E. P., **Buss, C.**, **Muftuler, L. T.**, **Head, K.**, **Hasso, A.**, **Wing, D. A.**, **Hobel, C.**, & **Sandman, C. A.** (2011). Children's Brain Development Benefits from Longer Gestation. *Frontiers in psychology*, **2**, 1. https://doi.org/10.3389/fpsyg.2011.00001

DeFranco, E. A., **Lian, M.**, **Muglia, L. A.**, & **Schootman, M.** (2008). Area-level poverty and preterm birth risk: a population-based multilevel analysis. *BMC Public Health* **8**, 316. DOI: 10.1186/1471-2458-8-316

Donnellan, E., **Bannard, C.**, **McGillion, M. L.**, **Slocombe, K. E.**, & **Matthews, D.** (2020). Infants' intentionally communicative vocalizations elicit responses from caregivers and are the best predictors of the transition to language: A longitudinal investigation of infants' vocalizations, gestures and word production. *Developmental science*, **23**(1), e12843. https://doi.org/10.1111/desc.12843

Duncan, G. J., **Magnuson, K.**, & **Votruba-Drzal, E.** (2015). *Children and socioeconomic status*. In Handbook of Child Psychology and Developmental Science, ed. R. M. Lerner, M.H. Bornstein, & T. Leventhal, **4**:534–73. Hoboken, NJ: Wiley.

Eilers, R. E., **Oller, D. K.**, **Levine, S.**, **Basinger, D.**, **Lynch, M. P.**, & **Urbano, R.** (1993). The role of prematurity and socioeconomic status in the onset of canonical babbling in infants. *Infant Behavior and Development* **16**(3), 297–315. https://doi.org/10.1016/0163-6383(93)80037-9.

Ellwood-Lowe, M. E., **Foushee, R.**, & **Srinivasan, M.** (2022). What causes the word gap? Financial concerns may systematically suppress child-directed speech. *Developmental Science* **25**(1), e13151. https://doi.org/10.1111/desc.13151

Espel, E. V., **Glynn, L. M.**, **Sandman, C. A.**, & **Davis, E. P.** (2014). Longer gestation among children born full term influences cognitive and motor development. *PloS one*, **9**(11), e113758. https://doi.org/10.1371/journal.pone.0113758

Farah, M. J., **Shera, D. M.**, **Savage, J. H.**, **Betancourt, L.**, **Giannetta, J. M.**, **Brodsky, N. L.**, **Malmud, E. K.**, & **Hurt, H.** (2006). Childhood poverty: specific associations with neurocognitive development. *Brain research* **1110**(1), 166–174. DOI: 10.1016/j.brainres.2006.06.072

Farver, J. A. M., **Xu, Y.**, **Eppe, S.**, & **Lonigan, C. J.** (2006). Home environments and young Latino children's school readiness. *Early Childhood Research Quarterly* **21**(2), 196–212. DOI: 10.1037/a0028766

Fernald, A., **Marchman, V. A.**, & **Weisleder, A.** (2013). SES differences in language processing skill and vocabulary are evident at 18 months. *Developmental science* **16**(2), 234–248. DOI: 10.1111/desc.12019

Foster-Cohen, S., **Edgin, J.**, **Champion, P.**, & **Woodward, L.** (2007). Early delayed language development in very preterm infants: Evidence from the MacArthur-Bates CDI. *Journal of Child Language* **34**(3), 655–675. DOI: 10.1017/S0305000907008070

Gilkerson, J., **Richards, J. A.**, **Greenwood, C. R.**, & **Montgomery, J. K.** (2017a). Language assessment in a snap: Monitoring progress up to 36 months. *Child Language Teaching and Therapy* **33**(2), 99–115. DOI: 10.1177/0265659016660599

Gilkerson, J., **Richards, J. A.**, **Warren, S. F.**, **Montgomery, J. K.**, **Greenwood, C. R.**, **Kimbrough Oller, D.**, **Hansen, J.**, & **Paul, T. D.** (2017b). Mapping the Early Language Environment Using All-Day Recordings and Automated Analysis. *American journal of speech-language pathology*, **26**(2), 248–265. DOI:10.1044/2016_AJSLP-15-0169

Gilkerson, J., **Richards, J. A.**, **Warren, S. F.**, **Oller, D. K.**, **Russo, R.**, & **Vohr, B.** (2018). Language Experience in the Second Year of Life and Language Outcomes in Late Childhood. *Pediatrics*, **142**(4), e20174276. https://doi.org/10.1542/peds.2017-4276

Ginsborg, J. (2006). *The effects of socio-economic status on children's language acquisition and use*. In Language and Social Disadvantage: Theory into Practice, ed. J Clegg, J Ginsborg, pp. 9–27. Hoboken, NJ: Wiley.

Glascoe, F. P., & **Brigance, A.** (2002). *Brigance Infant and Toddler Screen: Parent-Child Interactions Form*. North Billerica, MA: Curriculum Associates.

Gleason, J. L., **Gilman, S. E.**, **Sundaram, R.**, **Yeung, E.**, **Putnick, D. L.**, **Vafai, Y.**, **Saha, A.**, & **Grantz, K. L.** (2022). Gestational age at term delivery and children's neurocognitive development. *International Journal of Epidemiology*, **50**(6), 1814–1823. https://doi.org/10.1093/ije/dyab134

Gonzalez-Gomez, N., **O'Brien, F.**, & **Harris, M.** (2021). The effects of prematurity and socioeconomic deprivation on early speech perception: A story of two different delays. *Developmental Science* **24**, e13020. DOI: 10.1111/desc.13020

Hart, B., & **Risley, T. R.** (1995). *Meaningful differences in the everyday experience of young American children*. Paul H Brookes Publishing.

Hoff, E. (2003). The specificity of environmental influence: Socioeconomic status affects early vocabulary development via maternal speech. *Child Development* **74**, 1368–1378. DOI: 10.1111/1467-8624.00612

Hüppi, P. S., **Warfield, S.**, **Kikinis, R.**, **Barnes, P. D.**, **Zientara, G. P.**, **Jolesz, F. A.**, **Tsuji, M. K.**, & **Volpe, J. J.** (1998). Quantitative magnetic resonance imaging of brain development in premature and mature newborns. *Annals of neurology* **43**(2), 224–235. DOI: 10.1002/ana.410430213

Iverson, J. M., & **Goldin-Meadow, S.** (2005). Gesture paves the way for language development. *Psychological Science*, **16**(5), 367–371.

McDowell, K. D., **Lonigan, C. J.**, & **Goldstein, H.** (2007). Relations among socioeconomic status, age, and predictors of phonological awareness. Journal of speech, language, and hearing research: *Journal of Speech, Language, and Hearing Research* **50**(4), 1079–1092. DOI: 10.1044/1092-4388(2007/075)

McGillion, M., **Herbert, J. S.**, **Pine, J.**, **Vihman, M.**, **dePaolis, R.**, **Keren-Portnoy, T.**, & **Matthews, D.** (2017). What Paves the Way to Conventional Language? The Predictive Value of Babble, Pointing, and Socioeconomic Status. *Child development*, **88**(1), 156–166. https://doi.org/10.1111/cdev.12671

Melvin, S. A., **Brito, N. H.**, **Mack, L. J.**, **Engelhardt, L. E.**, **Fifer, W. P.**, **Elliott, A. J.**, & **Noble, K. G.** (2017). Home Environment, But Not Socioeconomic Status, is Linked to Differences in Early Phonetic Perception Ability. *Infancy: the official journal of the International Society on Infant Studies*, **22**(1), 42–55. https://doi.org/10.1111/infa.12145

Noel, M., **Peterson, C.**, & **Jesso, B.** (2008). The relationship of parenting stress and child temperament to language development among economically disadvantaged preschoolers. *Journal of Child Language* **35**(4), 823–843. DOI: 10.1017/S0305000908008805

O'Connor, D. B., **Thayer, J. F.**, & **Vedhara, K.** (2021). Stress and Health: A Review of Psychobiological Processes. *Annual Review of Psychology* **72**:1, 663–688. DOI: 10.1146/annurev-psych-062520-122331

OECD Better Life Index. (2016). *Income*. https://www.oecdbetterlifeindex.org/topics/income/

Onderwijs in Cijfers. (2019). *Opleidingsniveau van de bevolking.*

Pace, A., **Luo, R.**, **Hirsh-Pasek, K.**, & **Golinkoff, M. G.** (2017). Identifying Pathways between Socioeconomic Status and Language Development. *Annual Review of Linguistics* **3**(1), 285–308. DOI: 10.1146/annurev-linguistics-011516-034226

Pennington, B., **Van Orden, G.**, **Smith, S.**, **Green, P.**, & **Haith, M.** (1990). Phonological Processing Skills and Deficits in Adult Dyslexics. *Child Development* **61**(6), 1753–1778. DOI: 10.1111/j.1467-8624.1990.tb03564.x

Perkins, S. C., **Finegood, E. D.**, & **Swain, J. E.** (2013). Poverty and language development: roles of parenting and stress. *Innovations in clinical neuroscience* **10**(4), 10–19.

Rowe, M. L. (2012). A longitudinal investigation of the role of quantity and quality of child-directed speech in vocabulary development. *Child development*, **83**(5), 1762–1774. https://doi.org/10.1111/j.1467-8624.2012.01805.x

Rowe, M. L., & **Goldin-Meadow, S.** (2009). Early gesture selectively predicts later language learning. *Developmental Science* **12**, 182–87. DOI: 10.1111/j.1467-7687.2008.00764

Schaeffer, J.C., **van Bakel, H.J.A.**, & **Dirks, E.** (2021). Dutch translation of the LENA Developmental Snapshot. Unpublished.

Sperry, D. E., **Sperry, L. L.**, & **Miller, P. J.** (2019). Reexamining the Verbal Environments of Children From Different Socioeconomic Backgrounds. *Child development*, **90**(4), 1303–1318. https://doi.org/10.1111/cdev.13072

Stevens, C., **Lauinger, B.**, & **Neville, H.** (2009). Differences in the neural mechanisms of selective attention in children from different socioeconomic backgrounds: an event-related brain potential study. *Developmental science* **12**(4), 634–646. DOI: 10.1111/j.1467-7687.2009.00807.x

Vanormelingen, L., & **Gillis, S.** (2016). The influence of socio-economic status on mothers' volubility and responsiveness in a monolingual Dutch-speaking sample. *First Language* **36**(2), 140–156. DOI: 10.1177/0142723716639502

Vanormelingen, L., **Faes, J.**, & **Gillis, S.** (2020). Language development in children from different SES backgrounds: Babbling onset and consonant characteristics. *Dutch Journal of Applied Linguistics* **9**(1-2), 132–161. DOI:10.1075/dujal.19032.van

Vliegenthart, J., **Noppe, G.**, **van Rossum, E. F.**, **Koper, J. W.**, **Raat, H.**, & **van den Akker, E. L.** (2016). Socioeconomic status in children is associated with hair cortisol levels as a biological measure of chronic stress. *Psychoneuroendocrinology* **65**, 9–14. DOI: 10.1016/j.psyneuen.2015.11.022

Walker, D., **Greenwood, C.**, **Hart, B.**, & **Carta, J.** (1994). Prediction of school outcomes based on early language production and socioeconomic factors. *Child development* **65**(2 Spec No), 606–621.

Weisleder, A., & **Fernald, A.** (2013). Talking to children matters: early language experience strengthens processing and builds vocabulary. *Psychological science*, **24**(11), 2143–2152. DOI: 10.1177/0956797613488145

Werker, J., & **Tees, R. C.** (1984). Cross-language speech perception: Evidence for perceptual reorganization during the first year of life. *Infant Behavior & Development*, **7**, 49–63. DOI: 10.1016/S0163-6383(84)80022-3

Zhang, Y., **Tardif, T.**, **Shu, H.**, **Li, H.**, **Liu, H.**, **McBride-Chang, C.**, **Liang, W.**, & **Zhang, Z.** (2013). Phonological skills and vocabulary knowledge mediate socioeconomic status effects in predicting reading outcomes for Chinese children. *Developmental Psychology* **49**(4), 665–671. DOI: 10.1037/a0028612

Cite this article: Der Nederlanden, S.J., Schaeffer, J.C., Van Bakel, H.H.J.A., & **Dirks, E.** (2025). Socio-economic status and other potential risk factors for language development in the first year of life. *Journal of Child Language* **52,** 42–62, https://doi.org/10.1017/S0305000923000478