

**Unique effects of book-reading at 9-months on vocabulary development at 36-months:
Insights from a nationally representative sample of Irish families**

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Abstract

It is well-established that participation in shared book reading interactions with caregivers supports children's early language and literacy development. Most of this literature focuses on reading experiences during the preschool period. Less is known about the nature and importance of such practices during infancy. Therefore, the goal of this study was to examine literacy practices between parents and infants in a large cohort study, *Growing Up in Ireland*. Interview, survey, and direct measurements of children's language skills were used to examine whether parent-report of book reading practices when children were 9-months predicted child expressive vocabulary at 36-months (N=9,171). Regression analysis indicated that approximately 80% of 9-month-old Irish children are read to by parents. Characteristics of families who were more likely to report reading with children emerged: those with higher educational attainment, fewer depressive symptoms, and those who report a high-quality home language environment (e.g., reported talking more to children during everyday activities). Furthermore, children who were read to at 9-months had stronger expressive vocabulary skills at 36-months, even after accounting for socio-demographic and home literacy environment covariates measured at both 9- and 36-months. Results are discussed using a bioecological framework to describe how proximal and distal factors in the child's environment converge to impact early childhood literacy development.

Keywords: shared book-reading; infancy; literacy; parents

Participation in literacy practices in the home during early childhood sets the foundation for children's later language and literacy development. One facet of the home literacy environment, shared book-reading between a caregiver and child, is especially predictive of oral language abilities, kindergarten readiness, and achievement over time and across a broad range of domains (Bus et al., 1995, DeBaryshe, 1995; Mol et al., 2008; Ninio, 1983; Raikes et al. 2006, Scarborough & Dobrich, 1994; Sénéchal & Cornell, 1993). Most prior research has focused on shared book-reading during the toddler or preschool period (Fletcher & Reese, 2005). Less is known about book reading practices between parents and infants under age one. In this study, we examine whether there is a unique effect of shared book-reading between parents and their 9-month infants on their child's subsequent language outcomes at 36-months. We also examine characteristics of parents who are most likely to report sharing books with infants and whether the association between early shared reading and later language outcomes operates indirectly through these demographic characteristics. Using a nationally representative sample of more than 9,000 Irish families, this study provides a unique opportunity to examine the role of early experience in the development of early childhood language and literacy.

Shared book-reading is an interactive experience between a book and two individuals, typically a child and adult. This experience can include but is not limited to reading the text, pointing to illustrations, defining words, or extra-textual discussions about the story. Shared reading is typically measured via the *frequency* of reading or *qualities* of the book-reading interaction itself (DeTemple & Snow, 2003; Fletcher & Reese, 2005; Ninio & Bruner, 1978). For example, *frequency* of reading is most often indexed via caregiver self-report, inviting caregivers to estimate the number of days per week (or month) they read with their children, or the number of minutes read per day (e.g., Lever & Sénéchal, 2011; Payne, Whitehurst & Angell, 1994; Phillips,

Norris, & Anderson, 2008; Sim & Berthelsen, 2014). There is also a large literature on the specific *qualities* of book-reading interactions that support language development. For example, caregiver extratextual talk (e.g., labelling, questions, predictions) and references to print features (e.g., pointing and tracking text) support children's growing oral and written language skills (Demir-Lira, Applebaum, Goldin-Meadow, & Levine, 2019; Fletcher & Reese, 2005; Fletcher, Cross, Tanney, Schneider, & Finch, 2008; Hindman, Skibbe, & Foster, 2014; Justice & Ezell, 2000; Mol et al., 2008; Muhinyi & Rowe, 2019). Examining frequency and qualities of reading are both beneficial approaches, as they provide complementary perspectives on the role of shared book reading in early childhood. The present study uses a large-scale, population-based dataset, for which quality measures were not collected. This is typical of studies of this type, and as such, our variable of interest was the presence of shared book-reading, operationalized by whether the parent reported reading with the infant or not.

Theoretical Framework

This study is framed by two theories describing how children's environment influences their early language and literacy development: the bioecological model (Bronfenbrenner & Morris, 1998; 2007) and the social-interactionist theory of learning (Bruner, 1982; Vygotsky, 1978). First, the bioecological model of human development describes a series of nested structures and processes that sequentially affect children's development (Bronfenbrenner & Morris, 1998; 2007). This theory describes how distal processes (e.g., family's socio-economic situation, geographic location, or neighborhood context) affect proximal processes (e.g., caregiver behaviors and interactions) to, in turn, influence developmental outcomes. Applied to children's oral language development, the current study examines effects of the Irish context, socioeconomic status, qualities of the child's caregiver, and facets of the home literacy environment. A second

framework, the social-interactionist theory, describes aspects of the home literacy environment that help shape children's language and literacy acquisition. This theory states that children learn via input from and interaction with more knowledgeable others (Bruner, 1982; Vygotsky, 1978). Under this framework, interactions such as shared book-reading provide children with rich language input, namely exposing them to new words and providing them with a context in which to use these words.

Shared book-reading in infancy

Although the effects of shared book-reading on language and literacy outcomes can be modest during early childhood (Noble et al., 2019; Scarborough & Dobrich, 1994), they are thought to build early foundations in oral language skills such as vocabulary, which prepare children for kindergarten, and, in turn, support later reading acquisition (Duff, Reen, Plunkett, & Nation; Raikes et al., 2006). In Western, English-speaking countries the average onset of shared book-reading occurs when children are between 6- to 9-months (DeBaryshe, 1993; Kuo et al., 2004; Phillips and Lonigan, 2009, Richman & Colombo, 2007), although other studies have found reading onset to be as late as 22-months (Dunst, Simkus & Hamby, 2012).

There is a small but growing body of research using large-scale population based datasets to examine the association between shared reading in infancy and child language and literacy outcomes. In such large-scale datasets, parents are typically asked to report the frequency of book sharing, which is then examined in relation to concurrent or future measures of child language and literacy. For example, data from the Early Childhood Longitudinal Study-Birth Cohort (ECLS-B) found that maternal report of shared book reading at 9-months was associated with children's vocabulary size at 24-months (Paulson, Keefe & Leiferman, 2009) and emergent literacy at kindergarten entry (Feng, Gai & Chen, 2014). Similar longitudinal relations between shared book

reading and child vocabulary have been found using the Growing Up in Australia--Longitudinal Study of Australian Children (LSAC), finding that shared book-reading to 12-month infants was positively associated with language skills both concurrently and in the child's second year of life (Farrant & Zubrick, 2012, 2013). A nationally representative sample of German children (German National Educational Panel Study; NEPS) found that parental report of shared book reading frequency at 7 months predicted children's vocabulary and grammar skills at 26 months (Attig & Weinert, 2020). Data from the Growing up in Scotland Study found that reading to children at 10 months predicted vocabulary outcomes at 24 months (Bromley, 2009). Murray and Egan (2014) used a similar sample to the present study, The Growing up in Ireland Study, and found a positive relation between parent-infant shared book reading and infants' communication abilities, both measured at 9-months.

Non-population based studies with small samples also find positive relations between the frequency of shared reading with infants and language and literacy outcomes. Karrass and Braungart-Rieker (2005) examined this question longitudinally, finding relations between the frequency of book reading at 8-months and children's expressive and receptive vocabulary abilities at 12- and 16-months. Interestingly, they found no effect of shared reading when infants were 4-months on later expressive vocabulary skills. More recently, O'Farrelly, Doyle, Victory, and Palamaro-Munsell (2018) found that providing mothers with books increased daily reading when infants were 6-months, which, in turn, led to stronger receptive and expressive vocabulary scores at 12-months. Importantly, this study employed an intervention design, which afforded the authors the ability to make a causal claim about the role of shared book reading in infancy for language outcomes. Taken together, previous research indicates that shared book-reading with infants under 12-months of age supports their language outcomes at least one year later. Yet, we know less about

the relations between these book reading experiences and language outcomes beyond one year. Understanding the predictive value of early shared book reading is important because it can inform future interventions which aim to support language and literacy outcomes (O'Farrelly et al., 2018).

One of the few studies to have examined longer-term outcomes asked parents to recall whether they read to children when they were infants (Nicklas, Cahrssen & Tayler, 2016). Parents who reported reading more frequently had children with stronger language abilities at kindergarten, as measured by the Woodcock-Johnson standardized assessment. One limitation of this work is that it was not a prospective longitudinal study; instead, parents reported their reading practices at a delay, nearly five years later. Another relevant source of evidence comes from the Family Life Project, which longitudinally followed approximately 1,200 rural families in the United States who were socioeconomically and racially diverse starting when children were 6-months old. After controlling for maternal reading characteristics and education, fathers' use of diverse vocabulary during a wordless picture book interaction at six-months positively predicted child language at 15-months and 36-months (Pancsofar, Vernon-Feagans, and the Family Life Project Investigators, 2010). This work indicates that before the emergence of verbal and nonverbal communication (e.g., gesture), parental book-reading practices are already an important predictor of later vocabulary ability. Here, we seek to extend these findings by examining the importance of infant shared book reading in a larger, diverse, and nationally representative sample.

In contrast to the aforementioned studies, a number of studies failed to find relations between early shared book reading and later child language outcomes. For example, Raikes and colleagues (2006) found that parental reading at 24-months, but not 14-months, was predictive of 3-year-old language outcomes (although note they did find positive, concurrent relations between shared book-reading and vocabulary scores at 14-months). Similarly, Tomopoulous and colleagues

(2006) did not find a significant relation between shared book reading at six-months and children's language at 21 months in a small sample of lower-income families from the United States. These findings raise the question of whether there is a direct effect of infant shared reading on later outcomes and in addition, whether this effect operates indirectly through variables measured closer in time to the outcome. We examine both indirect and direct effects of shared reading in the present study.

Predictors of shared book-reading during infancy

If shared reading in infancy relates to later vocabulary development, it is important to understand the context under which this practice occurs as well as to identify the socio-demographic factors associated with the likelihood of reading to children when they are young. First, we considered which parent, if any, reports reading with the infant. Research that has compared mother and father book-reading practices indicates that fathers tend to read less frequently with children (Duursma, Pan & Raikes, 2008). For example, in the Netherlands, only 8% of households report fathers as the primary reader, though 70% of households report fathers read to children at some point (Duursma, 2014). Recent data from Kurcikova and colleagues (2018) revealed no differences in book-reading strategies by parent gender, although note that this study did not examine relations between book-reading practices and child outcomes. Studies that do include child language outcomes indicate that father-child book reading interactions make a unique contribution to children's language outcomes (Panscofar et al., 2010; Reynolds et al., 2019). Despite some recent studies including fathers in their samples, there still is little research on the extent to which dual-parent involvement in book-reading practices during infancy relates to children's later language and literacy development.

We also considered demographic factors that may influence whether shared book reading occurs at home: English-speaking status, family socioeconomic status (SES) and caregiver depressive symptoms. Ireland is a majority-English speaking country but there is a growing population of Ireland's population for whom English is not their first language. SES is typically defined as maternal years of education, income, occupation or a composite of these factors (McLoyd, 1998). Ninio (1980) was among the first to identify qualitative differences in book-reading practices between lower-SES and higher-SES mothers and their 17- to 22-month-old children. Subsequent studies indicate there are SES differences in both the frequency of book-reading (Farrant and Zubrick, 2012; Karrass, VanDeventer, & Braungart-Rieker, 2003; Kucirkova et al., 2018; Lyytinen, Laasko, Poikkeus, 1998; Raikes et al., 2006; Westerlund & Lagerberg, 2008), and in the onset of shared reading (Berkule, Dreyer, Huberman, Fierman, & Mendelsohn, 2007; Phillips and Lonigan, 2009). On average, higher-SES caregivers start reading to their infants earlier, report reading more frequently, and adopt a more 'demanding' reading style (e.g., ask more questions, encourage more participation from their child). Shared book reading practices explain, in part, SES-related differences in children's language and literacy development (Hart & Risley, 1995; Hoff, 2006; McNally, McCrory, Quigley & Murray, 2019; Walker & Carta, 2020).

However, the effect of SES on literacy practices and language ability in Irish populations is not well-characterized, especially in comparison to peer countries such as the UK, Australia, and the United States. Findings from the older cohort of children in the Growing up In Ireland study reveal some effects of SES on the home literacy resources available for early reading, such that 9-year-old Irish children with more educated mothers and those living in higher income households have more literacy resources such as books available to them (Williams et al., 2009). However, the effect of SES on literacy practices and language outcomes may be smaller in Ireland

than in other countries. Population-based statistics of Ireland indicate there is less variation in socioeconomic status as compared to peer countries (UK, Australia, United States; OECD.org 2019 poverty rate statistics). There is also a smaller SES-based achievement gap in children's literacy abilities compared to the average difference worldwide and peer-countries (OECD.org; PISA 2018). In a study of the association between maternal education and early language outcomes in Ireland, 78% of a six-point gap in expressive language at 36-months by maternal education was found to be explained by family resources and concurrent literacy practices, including number of books in the home (McNally et al., 2019).

A second parental characteristic that may influence book-reading practices with infants is the caregiver's mental health – in particular, postnatal depression (Cogill et al. 1986; Sohr-Preston & Scaramella 2006). Caregivers who present with depressive symptoms, on average, have less frequent and fewer positive interactions with their child (e.g., Pan, Rowe, Singer & Snow, 2005). This general pattern of interaction extends to shared book-reading, with depressed caregivers (examined almost exclusively with samples of mothers) less likely to read with children during the first two years of life, which in turn is associated with poorer child language outcomes (Bigatti, Cronon, & Anaya, 2001; Reissland, Sheperd & Herrera, 2003).

Current study

The current study addressed three research questions. Our first research question was descriptive in nature: what are the early literacy practices among families with 9-month old children in Ireland? In particular, do parents read to children in infancy and which parent or caregiver is most likely to do this? To address this question, we describe average book-reading practices within a nationally representative sample of children growing up in Ireland. We include data from both maternal and paternal book reading practices, acknowledging that both parents

contribute to the home literacy environment. This is a relatively underexplored context, as most studies on book reading that involve English-speaking samples have been conducted with mothers in the United States, Great Britain, or Australia and often include small samples or those that are not nationally representative. Consistent with prior studies using non-Irish samples, we predicted that there would be significant variation in the presence of shared book reading, with mothers being the primary reader to children.

The second research question explored the specific family and demographic characteristics that are associated with shared reading during infancy. To address this question, we sought to identify variables in infancy that were associated with an increased likelihood of engaging in shared book-reading at 9-months. We expected that particular demographic and maternal characteristics would emerge as predictors of reading during infancy: these children would have stronger communicative abilities at 9-months, hear more language input from caregivers, come from higher socioeconomic status families, and have mothers with fewer depressive symptoms. Communication skills at 9-months was examined because prior research with this dataset has found a positive association between shared reading and communication abilities (Murray & Egan, 2014). The amount of caregiver talk directed to children at 9-months was also examined given numerous studies indicating that parents who direct more speech to children have children with better oral language and emergent literacy abilities (Hart & Risley, 1995; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991, Hoff & Naigles, 2002; Pan, Rowe, Singer, & Snow, 2005). Research has also highlighted that the positive effect of talking with children begins early in life (Weisleder & Fernald, 2013). However, many studies that examine the effects of shared book-reading on language outcomes do not account for caregiver-child interactional effects outside of shared book-reading (e.g., Sénéchal & LeFevre, 2002).

The third research question asked about the effect of shared reading at 9-months on children's language outcomes at 36-months. Here we examined the possibility that effects of infant shared reading on later outcomes may operate both directly and indirectly, or may be moderated by socio-demographic factors. We had three predictions associated with this question. Our first prediction was that early shared book reading would exert a unique, direct effect on later vocabulary even after accounting for socio-demographic variables and other literacy practices described in research question two. Our second prediction was that the effect of shared reading during infancy may also relate to later outcomes indirectly via home literacy practices at 36-months. Typically, relations between literacy practices and language outcomes are stronger concurrently versus longitudinally (Raikes et al., 2006). Therefore, we considered the mediating role of the frequency of shared reading and the number of books in the home, as reported by the primary caregiver when the child was 36-months. As we describe further in the Method, parent-report measures of reading collected at 36-months were more detailed than those collected at 9-months.

Our third prediction was that a moderating effect would emerge such that the relationship between early shared reading and later language ability would vary by family income and parental level of education. Using data from the Longitudinal Study of Australian Children (LSAC), Shahaieian and colleagues (2018) found that early shared reading (at two years) had a stronger association with later language outcomes for children from lower and middle SES backgrounds. It was argued that effects of shared reading have a stronger effect on language and literacy outcomes for children from lower SES backgrounds because reading acts as a buffer against SES-related risk factors. We predict that the same moderating pattern will be observed in the present study.

Method

Participants

Archived data from two waves of the Growing Up in Ireland (GUI) Infant Cohort, a nationally representative longitudinal study of children in Ireland were analyzed in this study. Details of the study design can be found elsewhere (e.g., Williams, Murray, McCrory, & McNally, 2013). Data on children and their families were collected through interviews with the children's primary caregivers at 9-months (n=11,134). The majority of caregivers were White (94.3%), 2.4% were Black, 2.6% were Asian, and 0.7% self-reported as "other" or more than one ethnicity. At nine months 8,632 secondary caregivers (77.5% of the full cohort) completed a shorter interview and questionnaire. 1143 (10.3%) of resident secondary caregivers did not complete the questionnaire and a further 1359 of secondary caregivers (12.2%) were not residing with the child and primary caregiver.

When children were nine-months, parents were asked to self-identify as either the primary caregiver (defined by the GUI study team as the person who provided most care and who knew most about the study child) or secondary caregiver (defined by the GUI study team as the primary caregiver's resident spouse or partner). 99.9% of the primary caregivers were a biological parent (99.6% were the mother). The remaining .1% could be a non-biological parent through adoption or a relative (e.g., grandparent caring for the child). Nearly all of the primary caregivers were the mother of the child (99.7%) and nearly all secondary caregivers were the child's father (99.6% of those who completed the questionnaire). Interviews with primary and secondary caregivers were conducted by trained interviewers in the children's homes from 2008 to 2009 (wave 1) and from 2010 to 2011 (wave 2). Data on shared book reading at 9-months were gathered through the secondary caregiver questionnaire in families with two parents (n=8,614 surveys completed).

Direct assessments of the child's language skills were conducted by trained personnel at 36-months (n=9,793).

The full sample was randomly selected using the Child Benefit Register (CBR) as a sampling frame. Child benefit is a universal welfare entitlement in Ireland and has almost full coverage of all children residing in the Republic of Ireland at the time of the study. The sampling fraction for the study was approximately 1/4 of all infant births occurring in Ireland between 1st December 2007 and 30th June 2008. The sample was selected on a payee systematic basis, pre-stratifying by marital status, county of residence, nationality and number of children in the claim. A simple systematic selection procedure based on a random start and constant sampling fraction was used (Williams, Greene, McNally, Murray & Quail, 2010). The data were re-weighted prior to analysis using inverse probability weights to compensate for any imbalances in the sample as compared with the overall population. Further information concerning sample selection and statistical re-weighting of the sample is available elsewhere (Quail, Williams, McCrory, Murray & Thornton, 2011). Written informed consent was obtained from the child's primary caregiver at each wave of the study. Materials and procedures for GUI were reviewed and approved by the [blinded for review] Research Ethics Committee.

Materials and Procedures

Expressive Language. Expressive Vocabulary was measured using the Naming Vocabulary test from the British Abilities Scales II (Early Years) at 36-months (Elliott, Smith and McCulloch, 1997). Children were shown pictures of everyday objects and asked to name the object. Raw scores from the test (i.e. the number of items correctly named) constitute the unit of analysis in this paper. The test was administered in English so only answers given in English were acceptable. Children did not complete the vocabulary assessment if the primary caregiver felt that

the child would be unable to reasonably attempt the test due to insufficient English or a specific learning disability.

The BAS (II) Naming Vocabulary test has been used in similar circumstances by other cohort studies including the Millennium Cohort Study and Growing Up in Scotland, and was extensively piloted before its use in Growing Up in Ireland (GUI) (Murray, McCrory & Williams, 2014). The test authors (Elliott et al., 1997) report internal reliability of .86 for the Naming Vocabulary scale at ages 3:0 – 3:5 years. They also report a correlation of .68 with the Verbal IQ score on the Wechsler Preschool and Primary Scale of Intelligence – Revised (Wechsler, 1989) based on a sample of children aged between 3:6 and 5:10 years (Elliott et al., 1997).

Reading to the infant at nine months. Our primary explanatory variable was whether or not the child was read to. Secondary caregivers were asked as part of the main questionnaire, ‘Who does the following with baby – reads to him/her?’ and chose one of seven responses: (1) “always yourself”, (2) “usually yourself”, (3) “about equally by you and partner”, (4) “usually spouse/partner”, (5) “always spouse/partner”, (6) “someone else”, or (7) “no one does this”. This variable was recoded into a binary variable (where infant was coded as being read to or not at 9-months).

Additional predictor variables of literacy practices at nine months.

Infant’s sex (wave 1): Binary variable of male or female.

Mother’s talk to infant at 9-months (wave 1). Primary caregivers were asked how often they talked to the infant while busy doing other things such as housework. The original five categories ranged from ‘never’ to ‘always’. ‘Never’ (2.3%), ‘rarely’ (.4%) and ‘sometimes’ (7.5%) were combined for this analysis due to low cell counts and as a combined category were indicative

of less frequent language input. 'Often' (24.5%) and 'always' (65.3%) were combined as one category indicative of more frequent language input.

Maternal Mental Health at 9-months (wave 1): The Total Depression Score from the short, eight-item version, of the Centre for Epidemiological Studies-Depression (CES-D) scale (Melchior, Huba, Brown, & Reback, 1993) was used as a continuous variable. The CES-D was designed as a screening instrument for the general population. Sample items include: "I felt that I could not shake off the blues even with help from my family and friends" and "I thought my life had been a failure", which were answered on a four-point Likert scale ranging from 0 (<1 day) to 3 (5–7 days), with reference to the previous seven-day period. Scores range from zero to 24. Composite scores of above or equal to seven can be classified as depressed and scores below seven defined as not depressed (as reported by Quail et al., 2011).

Maternal Education (wave 1). Mothers reported their highest level of educational attainment. An original list of 13 levels ranging from 'no formal education' to 'Doctorate' was reduced to four categories as follows: lower secondary schooling or less (a maximum of 11 years of formal education, similar to a GED in the United States), higher secondary schooling (13 to 14 years of formal education, equivalent to a high school degree or diploma), certificate/diploma (14 to 15 years of formal education, equivalent to an associates degree), degree or postgraduate (a minimum of 16 years of formal education, equivalent to a four-year college degree or higher).

Household Income (wave 1). The GUI study recorded disposable family income as the total household income less statutory deductions of income tax and social insurance contributions. This analysis uses the household equivalized income, which was calculated as the disposable household income divided by equivalized household size (i.e., accounting for differences in size and composition of households in terms of the number of adults and children per household) (Quail,

Williams, McCrory, Murray & Thornton, 2011). Data were converted to income quintiles for this analysis.

English language in home (wave 1). The primary caregiver was asked ‘Is English spoken in the home’ (Yes/No).

Ages and Stages Questionnaire (ASQ, 2nd Edition), Communication Sub-Scale (wave 1): The communication subscale is one of five domains assessed by the ASQ (Squire, Potter & Bricker, 1999) with six questions per domain. The ASQ is organized as separate questionnaires for 19 age intervals ranging between four and 60 months. For this analysis, we used a dichotomous variable, ‘pass or fail’ on the 10-month communication questionnaire as indicative of communicative skills at 9-months.

Additional home literacy predictor variables of vocabulary at 36-months.

Frequency of reading to child at 36-months (wave 2). Primary caregivers were asked how many days per week (0-7) someone at home (not necessarily a parent) read to the child at 36-months.

Number of books in the house at 36-months (wave 2). Primary caregivers reported the number of children’s books available to the child in their home at 36-months using a five-point ordinal scale ranging from ‘none’ to ‘more than 30’ books. The last two categories were collapsed to create a three-level variable: ‘fewer than 10’, ‘10-30’, or ‘more than 30 books’.

Statistical Analysis Plan

All analyses were undertaken in Mplus (Muthén & Muthén, 2017). The sample characteristics are described using means and standard deviations, or proportions for each of the variables as appropriate at wave one. The independent association of infant shared book reading with covariates at 9-months (maternal characteristics, infant-directed speech and performance on

the ASQ Communication scale) were estimated using a series of logistic regressions. The bivariate association of infant shared book reading with performance on the BAS Naming Vocabulary scale at 36-months was first estimated using linear regression. To facilitate the interpretation of effect sizes, the BAS Naming Vocabulary scale was standardized to have a mean of zero and standard deviation of one before analysis. Linear regression was then used to examine the extent to which infant shared book reading predicted vocabulary scores at 36-months controlling for language and literacy covariates measured at 9- months. To quantify effect sizes, the association between the binary shared book reading variable and vocabulary scores is expressed in standard deviation units. Mediation analysis was used to estimate the indirect effect of infant shared book reading on vocabulary scores via the frequency of reading to child at 36-months and number of books in the house at 36-months. The two mediators were examined in parallel with 95% confidence intervals for the indirect effects generated using bootstrap resampling (N = 10,000 bootstrap samples). A final analysis tested whether the association between shared reading and vocabulary was moderated by background socioeconomic status (i.e., maternal education level and household income at 9-months) or by child gender.

Missing data

The analytical sample for longitudinal analyses was comprised of those with available vocabulary scores and mediating variables at age 3 (n=9,171) and missing data on other predictor variables was handled using GUI survey weights and full-information maximum-likelihood estimation. Survey weights supplied by the GUI study team were applied for analysis at wave two to take into account differential nonresponse patterns within population subgroups and differential attrition between survey waves. For instance, a disproportionate number of low income families

did not participate at wave two and weights available in the data set help to ensure that original stratification and representativeness of the data is maintained).

On average 4.1% of baseline data from the age 9-months survey wave were missing (see Table S1). Missing data was minimal for the majority of variables assessed at 9-months with the exception of shared book reading (22.6% missing), household income (7.8% missing), and maternal depressive symptoms (1.7% missing). In the longitudinal model examining the relationship between shared reading at 9-months and vocabulary at 3-years missing data was handled using full-information maximum likelihood (FIML) estimation. FIML is a model-based approach where model covariates and auxiliary variables are used to minimize potential biases due to missing data. Values from all available data and variables are included in the likelihood function to account for uncertainty due to missing data and estimate the most likely population parameters. FIML allows point estimates and standard errors to be generated while simultaneously handling missing data under the missing at random assumption. Further, FIML has been shown to perform equivalently to multiple imputation in handling missing data (Lee & Shi, 2021) and estimates generated via FIML tend to have a superior statistical profile to traditional approaches such as listwise and pairwise deletion (Enders & Bandalos, 2001). In this study, marital status (married vs. not married) was sufficiently correlated with missingness on the shared reading variable ($\phi = -0.43, p < .001$) to warrant inclusion as an auxiliary variable (i.e., included in the model solely for the purpose of predicting missing values) (Dong & Peng, 2013).

A final analysis tested whether the association between shared reading and vocabulary was moderated by background socioeconomic status (i.e., maternal education level and household income at 9-months) or child gender.

Results

Key sample characteristics

Table 1 displays baseline characteristics for the sample of infants for whom we have data. In line with the Irish population, nearly all families in the sample reported speaking English at home (92.3%, $n=7954$). Consistent with the full GUI dataset of 11,134 infants, there was variability in income and education for the reduced sample of families in this analysis. Most families reported that the primary caregiver received an undergraduate or higher which is equivalent to at least a three-year college degree or higher (41.2%, $n=3551$). However, a sizable minority of primary caregivers also reported receiving a diploma, equivalent to a two-year degree (20.5%) or leaving certificate (30%), equivalent to a high school degree. Very few caregivers report receiving lower than a secondary schooling level, or less than a high school degree (8.2%). Regarding income, each income quintile contained between 14% and 20% of the sample, with the average household income in the third quintile ($M = 3.04$; $SD = 1.38$). Scores on the continuous maternal self-report measure of depression were very low on average with 96% of mothers scoring below the composite score indicative of clinical depression symptoms (i.e., a score above seven is considered to indicate clinical depressive symptoms).

Literacy practices at 9-months

Our first research question sought to describe family literacy practices at 9-months, exploring the extent to which children were being read to and by whom. Table 1 displays descriptive statistics for early literacy activities as self-reported by secondary caregivers ($N=8614$). A sizable minority of infants (almost one in five) were not read to at all at 9-months. Recall that the 9-month shared reading variable was dichotomous such that the secondary caregiver was asked whether the child was read to and if so by whom. In this sample, 19.3% of infants ($n=1661$) were reportedly not read to by any caregiver. Infants who were read to were most likely to be read to by both parents (41.1%, $n=3538$) or by the mother (35.9%, $n=3089$). Very few families reported that

only the father read with the infant (3%), and 0.7% (n=64) of families reported someone else reading to the infant. Variability in reading to infants at 9-months contrasted with a high degree of consistency in maternal reports of talking to the infant. 89.8% of mothers spoke to the child *always* or *often*, in contrast to only 9.7% of mothers who reported *sometimes*, *rarely* or *never* talking with their infant. This indicates that the majority of infants were receiving high levels of caregiver speech input – outside of book reading – during the day.

Predictors of shared book reading during infancy

The second research question examined potential sociodemographic variables that were associated with an increased likelihood of caregivers engaging in shared book-reading when children were 9-months. Zero-order correlations between study covariates and dependent variables can be found in Table S3. We examined the independent association between shared book-reading at 9-months and four maternal variables in a series of logistic regressions reported in Table 2: child-directed caregiver talk, maternal postnatal depression, maternal education, and income. We also examined the independent association between whether children received a ‘pass’ score on the communication subscale of the ASQ and shared book-reading at 9 months. Child-directed caregiver talk was positively associated with shared book-reading, as was maternal education. Maternal postnatal depression was negatively and significantly related to shared book-reading practices at 9-months. Infants with who passed the ASQ communication subscale test were more likely to have been read to at 9 months. Family income was not significantly associated with book-reading practices at nine-months, a finding we return to in more detail in the Discussion.

Direct and indirect effects of Infant shared book reading on language outcomes at 36 months

In our third research question, we examined the direct and indirect effects of infant shared book reading on vocabulary skills at 36-months. Table 3 reports sample language and literacy

characteristics at 36-months and shows significant variation in these practices. First, we examined whether there was a unique, direct effect after controlling for 9-month covariates of shared book reading and 36-month literacy covariates. A hierarchical linear regression (see Table 4) tested the direct association between infant shared book reading and vocabulary at 36-months controlling for covariates from 9-months (model 1) and the 36-month home literacy variables (model 2). Covariates included in model 1 were infant-directed caregiver talk, CES-D scores, maternal education, household income, English-speaking status, and 9-month communication scores from the ASQ, and child gender. Infant shared book reading was a significant predictor ($B = .13$, $t = 3.77$, $p < .001$; 95% CI: .07, .20), in addition to maternal education, household income, infant-directed talk, communication scores at 9-months, and whether English was spoken in the home at 9-months. Maternal depression was not predictive of vocabulary at 36-months in this model. This regression model indicates that book reading at nine-months has a significant, albeit small association with subsequent child vocabulary outcomes.

Table 4 Model 2 shows that association between shared reading at 9-months and vocabulary at 36-months was reduced but remained statistically significant ($B = .09$, $t = 2.73$, $p < .01$; 95% CI: .03, .15) after adjustment for frequency of shared book reading and number of children's books in the home at 36-months. Frequency of reading to the child at age 36-months ($B = .06$, $t = 8.50$, $p < .001$) positively predicted vocabulary at 36-months. Similarly, having a greater number of children's books in the home ($B = .14$, $t = 9.77$, $p < .001$) positively predicted vocabulary at 36-months.

To examine potential indirect effects of book reading on language outcomes, we conducted a mediation analysis with 36-month home literacy variables as mediators. Analyses confirmed that indirect effects of shared reading at 9-months on vocabulary at 36-months through the frequency

of reading to the child ($d = .03$, $t = 4.72$, $p < .001$; 95% CI: .02, .04) and number of books in the home at 36-months ($d = .02$, $t = 3.20$, $p < .01$; 95% CI: .01, .03), as shown in Table 5. Taken together both variables explained 30.8% of the shared reading – vocabulary association. Mediation analyses therefore suggest that early shared reading at nine-months is associated with future language outcomes both directly and indirectly, through future measures of the home literacy environment.

Finally, we tested for potential moderation effects of socioeconomic status on the association between shared reading and later language outcomes. We also examined whether child gender served as a moderator because gender differences in 36-month language outcomes were observed in this dataset. There was no evidence that this association was moderated by maternal education level, household income at 9-months, or child gender (see Table S2). Thus, the positive association between shared reading and language outcomes at 36-months appears to be similarly strong for families from varied socioeconomic backgrounds and for both boys and girls.

Discussion

This study offers a picture of the early literacy practices in Irish families, and the extent to which these practices relate to children’s later language skills at 36-months. We focused on book-reading as the literacy practice of interest, given its consistent and strong association with future language and literacy outcomes (Baker, 2013; Bus et al., 1995; Noble et al., 2019; Mol et al., 2008; Sénéchal & LeFevre 2002; Zucker, Cabell, Justice, Pentimonti & Kaderavek, 2012). There is little research on shared book reading practices before 12 months of age, and even less that examines relations to language abilities past two years of age. We fill this gap by showing that book-reading practices at nine-months significantly predict children’s language outcomes at 36-months in a large, nationally representative sample of Irish families. We find that shared reading has both a

direct and indirect relation to 36-month language outcomes, and both relations held after controlling for socio-demographic covariates. These data point to the importance of engaging families early on in literacy practices and hold a number of important insights related to both the theory and practice of literacy development, which we expand on below.

Reading during infancy is prevalent among Irish families

Our sample of over 9,000 families in Ireland indicated that many children are read to by parents during infancy. However, a significant proportion -- nearly 20 percent -- are not. In addition, most Irish children growing up in two-parent families are read to by both caregivers. Reading practices in Ireland are therefore both similar and different to other Western, English-speaking countries. For instance, although the Early Childhood Longitudinal Study – Birth Cohort data from the United States does not provide overall prevalence rates, it showed that 9-month-old children are read to by both mothers and fathers: mothers approximately four times per week and twice per week by fathers (Paulson, Keefe & Leiferman, 2009). In contrast, these data differ from those reported in The Longitudinal Study of Australian Children (LSAC; Harrison, McLeod, Berthelsen, & Walker, 2009), which found that only 5% of children are not read to at all (Williams, Barrett, Welch, Abad & Broughton, 2015). However, direct comparisons between GUI and LSAC are difficult because the shared reading measure was collected at different time points, with GUI at 9-months and LSAC at 12-months. Small-scale, non-cohort studies with American samples report similar prevalence rates to the current data (Karrass & Braungart-Rieker, 2005).

Several socio-demographic factors were related to whether or not Irish parents read to their infants. These variables were identified based on prior literature and correlated with book reading practices in the expected direction: maternal education and caregiver talk were positively correlated while depressive symptoms were negatively correlated. These associations provide

support for Bronfenbrenner's bioecological model (Bronfenbrenner & Morris, 1998; 2007): distal factors such as maternal education influence developmental outcomes by way of proximal factors such as the home literacy environment. An explanation from previous studies for this pathway is that maternal education influences language development through cognitions such as knowledge and beliefs about child development (Curenton & Justice, 2008; Rowe, Denmark, Jones Harden & Stapleton, 2016). That is, there are average differences in what parents know about children's development by socioeconomic status, which partially explain variation in children's subsequent language and literacy skills. It should be mentioned that the effect of parental education on literacy practices was relatively small, perhaps explained by Ireland's relatively narrow achievement gap, small variation in family SES, or a combination of these factors (OECD.org).

Although many of the socio-demographic variables correlated with literacy practices at 9-months, family income did not. This null association runs counter to extant literature on socioeconomic status and the home literacy environment. For instance, research shows families with higher incomes are more likely to engage in literacy practices than those with lower incomes (Fletcher & Reese, 2005). We put forward three potential explanations for this null finding. First, socioeconomic status is a multidimensional construct, with maternal education a stronger predictor of the home literacy environment than family income or parental occupation (Hoff, 2006). On this hypothesis, the effect of education may subsume the effect of income in this population. However, this is not likely, as both education and income had a unique and significant effect on children's future language outcomes and were only moderately correlated ($r=.38$). Second, it is possible that variation in shared reading by family income may be more pronounced in measures of quality such as the amount of extratextual talk or parental engagement. Future studies that include video or audio data of Irish parent-child reading sessions could explore this hypothesis in further detail.

Third, unique demographics of Ireland may be important at contextualizing the role of family income in home literacy practices. Ireland has a strong welfare support system, resulting in less extreme income distribution and less between-person variation in income (Callan, Bercholz & Walsh, 2018) as well as a smaller poverty gap compared to peer countries (OECD.org). Therefore, family income in Irish populations may not be a strong driver of differences in the home literacy environment as compared to countries with more variation in family income. Interpreting this finding through a bioecological lens shows how factors that are more distal to the child (in this case, economic policies of a country) alter the influence of less distal factors such as socioeconomic status on children's learning and development.

Regardless of the explanation for the null finding between income and 9-month literacy practices, there are practical implications that emerge from this data for future interventions with low-SES Irish families. For instance, researchers and practitioners may consider parental educational attainment rather than income as inclusionary criteria in order to identify families who may benefit the most from intervention supports.

Book reading in infancy is indirectly and directly related to later vocabulary

After establishing variation in early book reading practices and factors that predict its occurrence, we examined whether the shared book-reading at 9-months was associated with language skills when children were 36-months. Findings indicated that shared reading was both indirectly and directly associated with children's language ability at 36-months. Regarding the indirect association, early shared reading was related to later language outcomes via the number of books in the home and shared reading practices at 36-months. This mediated relation explained 30.8% percent of the variation in children's language outcomes. This indirect pathway is perhaps an expected finding, as the home literacy environment tends to remain stable over time such that

families who begin reading early on likely continue such practices as children grow older. Moreover, relations between literacy practices and language outcomes are stronger concurrently than they are longitudinally (Raikes et al., 2006). Nevertheless, we also observed a small, yet significant direct effect of 9-month shared reading on 36-month language outcomes. This association held even after accounting for 36-month home literacy environment variables as well as other demographic variables. These findings indicate that the home literacy environment at 36-months does not fully account for the variance observed in children's language abilities and that a small yet significant portion of variation in child language ability is attributable to the presence of shared reading at 9-months.

This study adds to previous research using GUI cohort data, namely Murray and Egan (2014) who examined concurrent relations between 9-month book reading practices and children's communicative abilities. The fact that shared reading when children were 9-months confers a benefit to their oral language nearly three years later is an important conclusion, given the strong relations between preschool oral language skill and future reading comprehension and broader academic achievement (Pace, Alper, Burchinal, Golinkoff & Hirsh-Pasek, 2019). Our data replicate and extend these findings by showing how the precursors of kindergarten readiness and academic achievement can be traced back to family practices (here, book-reading) in infancy.

In a final set of analyses, we examined whether the association between early shared reading and later language outcomes held across different sub-groups in this cohort study. Specifically, we examined whether socioeconomic status – both parental education and household income – as well as child gender moderated the association between shared reading practices and child language outcome. We found no evidence that any of the three variables moderated the relation. This suggests that the small yet significant effect of shared reading on language outcomes

exists for families from diverse socioeconomic backgrounds and for both boys and girls. Interestingly, the lack of a socioeconomic moderator is not consistent with findings from other cohort studies, namely LSAC who found that shared reading at age two was more strongly related to language abilities for children from low- and middle-socioeconomic backgrounds (Shahaeian et al., 2018). It is possible that Ireland's relatively narrow poverty gap may explain this difference, such that home literacy practices among families at the upper and lower ends of the SES spectrum are more similar in Ireland than in other peer countries such as Australia or the United States.

Implications

This study advances knowledge about the importance of book reading by identifying distal and proximal factors which are associated with early shared reading. More so, our data address this topic within an Irish context, for which little is known about the predictors and consequences of early shared reading. Even in a country with higher-than-average economic equality, our data show that variations in socioeconomic status – particularly maternal education – are still linked to differences in book reading practices. This is an important finding as it highlights the widespread effect of SES on child-rearing across Western, English speaking countries.

While SES is not directly or easily malleable, our data are nevertheless informative because they identify the caregivers who may benefit most from outreach efforts or through coordinated partnerships with early childhood care centers. For instance, because our data show that nearly 1 in 5 Irish children are not read to, interventions should focus on these families as recipients of family literacy intervention programs. This may involve strategies such as providing information to caregivers about the importance of early literacy practices, strategies for doing so (e.g., modeling book-reading interactions), and messages to build self-efficacy (Rowe & Leech, 2019). Efficacy messages may also be effective for building parental capacity around shared reading with infants

in particular, which many parents report is challenging (Bus & Van IJzendoorn, 1997). Large-scale programs in the United States such as *Reach out and Read* have found success with this approach through anticipatory guidance around literacy provided by pediatricians (Zuckerman, 2009). The ‘First-5: A Whole-of-Government Strategy for Babies, Young Children and their Families 2019-2028’ has committed to supporting early literacy activities, including piloting a ‘book bags’ initiative for families with young children (Government of Ireland, 2018), reflecting an increasing focus on the importance of early shared reading in Ireland. Additionally, book gifting to families with young infants is often part of programs that seek to improve outcomes for children living in areas of disadvantage in Ireland (e.g., the National Area Based Childhood (ABC) programs). In this context, early book gifting is at times part of a comprehensive home visiting initiative that supports families from birth through childhood (e.g., *Preparing for Life*, 2008). However, there is no national universal book gifting scheme from birth in Ireland and targeted supports for infant shared reading are predominantly for families in areas of social deprivation. Though we found some demographic-structuring of infant shared reading practices by levels of maternal education, our finding that shared book reading with infants predicted vocabulary skills at three years after controlling for SES extends our understanding of the importance of shared reading for all infants in Ireland, and provides support for a national universal approach to the provision of books.

Nevertheless, parent-focused interventions may be especially critical for parents with lower educational attainment or history of depression. Indeed, it was these demographic characteristics that most strongly correlated with reading practices in this sample. An evidence-backed message to parents could be that reading even in small amounts still confers benefits to language and literacy development. A tacit assumption held by many caregivers is that shared book reading should only

commence when the child begins producing verbal language, which as a result, prevents many adults from reading with children under age one.

Limitations

We must acknowledge several limitations of this study. First, the families included in this study were two-parent households where caregivers remained the same at both time points. Single parent households were not included in this sample, and as a result, the families in this sample may differ in some ways from the larger Irish population. It is possible that the families not included in the GUI sample differed on key socio-demographic characteristics such as income, parental education, or race/ethnicity. Indeed, we know that two-parent families are more likely than single-parent families to have higher incomes and higher SES in general. This sample composition is by necessity, as information about 9-month literacy practices was filled out by the secondary caregiver. It will be important for future research to examine how literacy practices in single caregiver households are similar to or different from those identified in the current sample.

A second limitation lies in the parent-report measure of shared book reading, which, while a commonly accepted method for assessing the home literacy environment, can be subject to social desirability. A final limitation involves our inability to look at multi-dimensional measures of book reading practices, such as both the quantity and quality of shared book reading. Because our study relied on an existing data from a longitudinal study, certain variables which may have explained additional variance in outcomes were not available in the dataset. For instance, the GUI dataset does not contain direct measures of parent-child book reading interactions, which would have allowed for qualitative aspects of shared reading such as extra-textual talk or engagement to be measured (Mol et al., 2008). Examining only the quantity of shared reading may be one reason why the effect sizes reported by this study are relatively small. It is likely that the inclusion of

qualitative measures would explain additional variance and yield larger effect sizes when predicting 36-month outcomes (Lonigan, 1994; Sénéchal & LeFevre, 2002).

Future Directions

With the above limitations in mind, there are several directions for future research. First, we know very little about developmentally appropriate strategies for engaging preverbal infants in shared book reading routines. One recent study suggested that parental open-ended questions while reading with 10-month old children related to 18-month language outcomes (Muhinyi & Rowe, 2019). It will be important to follow up on this work by identifying additional interactional features during shared booking reading that are developmentally appropriate for children under 12 months. Affective factors such as the emotional closeness with a caregiver or positive associations with books in general should also be examined as factors that may explain the relation between shared book reading in infancy and later language (Kuo et al., 2004). A second future direction is to understand whether earlier shared book reading – perhaps at 6-months or earlier – predicts oral language prior to school entry. Interventions are often more effective when implemented earlier rather than later in the child’s development, before routines are solidified. Therefore, understanding the earliest point at which shared reading matters for later vocabulary ability will help us develop targeted and effective intervention programs for caregivers.

Conclusion

Taken together, our data add additional support to the notion that the home literacy environment matters for children’s skill development. More broadly, these results implicate both proximal and distal factors that contribute to these developmental outcomes in an Irish context. Skills build on skills such that oral language ability has long-term effects on future achievement.

Here we show that starting shared book reading as early as 9 months can provide a solid foundation for this developmental sequence.

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INFANT BOOK-READING

Table 1

Sample Baseline Characteristics at 9-months (n = 8614)

Variable	Category	% or mean (SD)	n
Shared book reading at 9-months	No-one	19.3%	1661
	Mother	35.9%	3089
	Father	3%	262
	Both	41.1%	3538
	Someone else	.7%	64
Infant's Sex	Girl	48.7%	4198
Infant-directed Talk	Never/Rarely	2.7%	229
	Sometimes	7.5%	649
	Often	24.5%	2112
	Always	65.3%	5624
CES-D at 9-months*	PCG Mean Total Score	2.20 (3.35)	8503
Primary Caregiver Education*	Lower secondary or less	8.2%	709
	Upper secondary	30%	2584
	Associate's degree	20.5%	1767
	Degree/Postgrad	41.2%	3551
Equivalised Household Income Quintiles*	Lowest	14.1%	1213
	2 nd	16.3%	1402
	3 rd	20.8%	1673
	4 th	19.4%	1971
	5 th	20.8%	1790
English spoken in the home	English spoken	92.3%	7954
ASQ Communication Scale*	Passed 10-month	92.0%	7921

*Missing data for the reduced sample 8614 on the following variables ASQ (54), Education (3), Income (565– 6.6% in keeping with 7% missing data in fuller sample), and Depression scores (111). In keeping with full sample set, largest amount of missing data is for the income variable.

Table 2

Independent Associations between Infant Shared Book Reading and Sample Characteristics at 9-months (n=8614)

Variable	Infant Shared Book Reading Group (n=6,593) % or Mean (SD)	No Infant Shared Book Reading Group (n=1,661) % or Mean (SD)	OR (95% CI)
<i>Infant's Sex</i>			
Male†	51.4%	50.9%	1.00
Female	48.6%	49.1%	.98 (.88-1.09)
<i>Infant-Directed Caregiver Talk</i>			
Rarely/Never talks to infant†	9.7%	12.5%	1.00
Talks to infant	90.3%	87.5%	1.33 (1.13-1.57)**
<i>Maternal Depression (CES-D)</i>			
	2.16 (3.29)	2.35 (3.59)	.98 (.97-.99)*
<i>Maternal Education</i>			
Lower Secondary†	7.8%	10.1%	1.00
Upper Secondary	29.4%	32.5%	1.17 (.96-1.42)
Associate's Degree	20.9%	18.9%	1.43 (1.15-1.76)**
Degree/postgrad	41.9%	38.5%	1.40 (1.16-1.70)**
<i>Household Income (quintiles)</i>			
	3.22 (1.37)	3.18 (1.36)	1.03 (.99-1.07)
<i>Language spoken in home</i>			
English not spoken†	7.7%	7.5%	1.00
English spoken	92.3%	92.5%	0.98 (.80-1.20)
<i>ASQ communication scale</i>			
ASQ not passed at 10-months†	8.8%	9.2%	1.00
ASQ passed at 10-months	92.2%	90.8%	1.26 (1.04-1.53)*

†Reference category in logistic regression analyses.

* $p < .05$. ** $p < .01$.

Table 3

Sample Language and Literacy Characteristics at 36-Months (n=9,171)

Variable	Category	% or mean (SD)	n
BAS Vocabulary score	–	17.5 (5.3)	9171
Shared Book Reading (from 0 to 7 days)	–	5.63 (1.93)	9171
	0-2	9.4%	862
	3-5	27.1%	2485
	6-7	63.5%	5824
Books at home (from 1 = none, to 5 = 30+)	–	4.24 (0.99)	9171
	Fewer than 10	7.0%	642
	10-30	36.5%	3347
	>30	56.5%	5182

Table 4

Children’s Vocabulary Scores at 36-Months Explained by Infant Shared Book Reading and Covariates at 9-months and Literacy-related Mediating Variables at 36-months (N=9,171)

Variable	Vocabulary scores (z-score) ^a			
	<i>B</i>	<i>SE B</i>	<i>B</i>	<i>SE B</i>
Infant Shared Book Reading	0.13***	0.03	0.09**	0.03
Frequent Infant Directed Caregiver Talk	0.13**	0.04	0.09*	0.04
CES-D at 9-months	0.00	0.00	0.00	0.00
<i>Maternal education (ref=lower second level)</i>				
Upper Secondary	0.16***	0.04	0.08*	0.04
Associate’s Degree	0.22***	0.04	0.09*	0.05
Degree/postgrad	0.29***	0.04	0.13**	0.05
Household Income Quintiles (1 = lowest, 5 = highest)	0.11***	0.01	0.08***	0.01
English Spoken in the Home	1.29***	0.09	1.19***	0.10
ASQ Communication Scale (passed test at 10-months)	0.30***	0.05	0.30***	0.05
Infant’s sex (ref=male)	0.26***	0.02	0.23***	0.02
Children’s books in the home (1 = none, 5 = 30+)			0.06***	0.01
Number of days reads to the child (0-7 days)			0.14***	0.01

^a Estimates derived from a model where 36-month vocabulary scores are standardized to have a mean of 0 and standard deviation of 1.

p* <.05. *p* <.01. ****p* <.001.

Table 5

The Role of Literacy Characteristics at 36-months as Mediators of the Association between Infant Shared Book Reading and Children’s Vocabulary Scores at 36-Months.

	Vocabulary scores (z-score)		
	<i>B</i>	SE	95% CI
Total effect of shared book reading ^a	0.13***	0.03	0.07, 0.20
Direct effect of shared book reading ^b	0.09**	0.03	0.03, 0.15
Indirect effect via number of children’s books in home	0.03***	0.01	0.02, 0.04
Indirect effect via the number of days reads to the child	0.02**	0.01	0.01, 0.03

Note: Vocabulary scores are standardized to have a mean of zero and standard deviation of one.

^a Total increase in vocabulary scores associated with infant shared book reading.

^b Increase in vocabulary scores associated with infant shared book reading explained by literacy characteristics at 36-months.

^c Increase in vocabulary scores associated with infant shared book reading explained by the number of days per week someone in the home reads to the child.

* $p < .05$. ** $p < .01$. *** $p < .001$

Table S1***Percentage of Missing Data for Each Baseline Characteristic at 9-months (total n = 11,134).***

<i>Variable</i>	<i>% missing</i>	<i>n missing</i>
Shared book reading at 9-months	22.6%	2520
Infant's Sex	0.0%	0
Infant-directed Talk	0.0%	2
CES-D at 9-months	1.7%	194
Primary Caregiver Education	0.1%	10
Equivalised Household Income Quintiles	7.8%	864
English spoken in the home	0.0%	0
ASQ Communication Scale	0.6%	70

Table S2.

Results from Regression Models Examining Interactions between Socioeconomic Status and Shared Book Reading at 9-months in Predicting Vocabulary Scores at 36-months (N = 9,171).

	Vocabulary score (z-score)	
	<i>B</i>	SE
Household income interaction		
Shared reading	0.17*	0.08
Household income	0.13**	0.04
Shared reading * Household income	-0.01	0.02
Maternal education interaction		
Shared reading	0.08	0.10
Upper secondary	-0.03	0.20
Associate's Degree	0.16	0.21
Degree/postgrad	0.22	0.19
Shared reading * Upper Secondary	0.09	0.11
Shared reading * Associate's Degree	0.02	0.12
Shared reading * Degree/postgrad	0.02	0.10
Child gender interaction		
Shared reading	0.11**	0.04
Child is female	0.26*	0.11
Shared reading*female	0.01	0.06

^aMain effect of covariates assessed at 9-months included in models but not shown.

* $p < .05$. ** $p < .01$. *** $p < .001$

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Table S3. Correlation matrix of the association between key study variables (N = 9,171).

	Vocab. (36m)	Read to child (36m)	No. of books (36m)	Female	Depress. symptom	Upper second.	Associate degree	Degree	Income	Infant- directed talk	English spoken in home	ASQ passed
Read to child (36m)	0.221	1										
No. of books (36m)	0.257	0.364	1									
Female	0.125	0.052	0.043	1								
Depressive symptoms	-0.052	-0.065	-0.086	-0.025	1							
Upper secondary	-0.051	-0.087	-0.093	0.016	0.062	1						
Associate's degree	0.046	0.049	0.094	0.011	-0.047	-0.353	1					
Degree/postgrad	0.120	0.203	0.240	-0.031	-0.095	-0.454	-0.327	1				
Income	0.215	0.232	0.315	-0.014	-0.162	-0.198	0.104	0.398	1			
Infant-directed talk	0.053	0.072	0.034	-0.021	-0.023	0.002	0.013	0.002	0.037	1		
English spoken in the home	0.230	0.065	0.101	-0.015	0.004	-0.021	0.029	-0.002	0.098	0.026	1	
ASQ passed	0.076	-0.010	-0.015	0.042	-0.005	-0.006	0.020	-0.058	-0.044	0.039	0.026	1
Read to infant	0.063	0.099	0.062	-0.010	-0.017	-0.035	0.023	0.038	0.031	0.051	-0.006	0.035

Note: Correlations that are significant at the $p < .05$ level are highlighted in bold. Variables assessed when child was aged 9-months unless otherwise stated.