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The effects of book exposure and reading interest on oral language skills of children with and without a familial risk of dyslexia

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The potential role of home literacy environment (HLE) in children's language development has been widely studied. However, data on the HLE of children with familial risk (FR) of dyslexia are limited. In this longitudinal study, we examined (a) whether amount of book exposure and reading interest at age 4 were different in samples of Norwegian FR and no FR-children, respectively, (b) whether these home literacy-related factors exerted different effects depending on family-risk status on vocabulary and grammar skills at school entry age (6 years) and (c) whether they contributed independently to language outcomes at age 6, after controlling for the 4;6-year language skills. Results showed no significant between-group differences in book exposure and reading interest. Furthermore, while interest in reading did not affect vocabulary and grammar in either group, book exposure contributed to vocabulary skills only in the FR-group by school entry. However, this longitudinal association was mediated by lexical skills at age 4;6, implying that the HLE has a positive indirect effect on later language development through its effect on early language. Thus, these findings can be taken to suggest that early intervention including exposure to various book-reading activities

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for pre-school FR-children with poor expressive vocabulary is worth considering.

KEYWORDS

at-risk, dyslexia, grammar, home literacy environment, vocabulary

1 | INTRODUCTION

Parents and the home literacy environment (HLE) they create are considered to have an important role in the development of children's language and literacy skills, and understanding fully the role of HLE is of continued interest (e.g., Bus, Van Ijzendoorn, & Pellegrini, 1995; Frijters, Barron, & Brunello, 2000; Grolig, Cohrdes, Tiffin-Richards, & Schroeder, 2019; Niklas & Schneider, 2017). The "home literacy environment" usually refers to the experiences, attitudes and materials related to literacy that a child encounters and interacts with at home (Roberts, Jergens, & Burchinal, 2005). Despite the extensive research attention that the HLE has attracted, data on the HLE of children with a family history of dyslexia are scarce (Snowling & Melby-Lervåg, 2016) and mixed. While some studies report differences between the HLE experienced by children at family risk of dyslexia compared with those not at risk (e.g., Dilnot, Hamilton, Maughan, & Snowling, 2017; Scarborough, 1991), other studies report no difference (e.g., Elbro, Borstrøm, & Petersen, 1998; Torppa et al., 2007; van Bergen, de Jong, Maassen, & van der Leij, 2014). The current study attempts to fill this void by examining the relationship between HLE and language development in a sample of pre-schoolers at familial risk (FR) of dyslexia in comparison to a control group with no family risk (NoFR). More specifically, by considering whether FR-status serves as a moderating factor in this relationship, we investigate to what extent home literacy practices assessed at age 4 could predict broader oral language skills (i.e., vocabulary and grammar) around the time of school entry (age 6) in children with and without FR.

The concept of HLE has been operationalized using a variety of indicators, which are not consistent across studies (Schmitt, Simpson, & Friend, 2011). In a key study, Sénéchal and LeFevre (2002) have suggested that home-based literacy experiences that children are exposed to can be conceptualized into two broad categories as "formal" and "informal" activities. Formal literacy activities include shared parent-child focus on the print per se by, for example, talking about letter names and the corresponding sounds. Informal literacy activities, on the other hand, include shared focus on the meaning contained in the print. For example, during book reading, the parent may explain the moral of the story and the child may ask about the meanings of certain words (Sénéchal & LeFevre, 2002). Whereas formal home literacy experiences in the pre-school years have been shown to be related to emergent literacy skills such as letter knowledge, decoding and word recognition (Hood, Conlon, & Andrews, 2008; Torppa, Poikkeus, Laakso, Eklund, & Lyytinen, 2006), informal home literacy experiences appear to be associated with children's oral language development and comprehension skills (Mol, Bus, De Jong, & Smeets, 2008; Sénéchal & LeFevre, 2002; Sénéchal, Pagan, Lever, & Ouellette, 2008). In the present study, we focused on the informal aspect of the HLE, as our main objective was to examine its developmental relationship with children's lexical and grammatical skills before entry to formal schooling. We assessed four components of the HLE, which we categorized as book exposure: frequency of shared reading, parent as a role model for reading, access to books and number of books in the home. In addition, we measured child's own interest in book reading, another factor that is related to home literacy practices and may contribute to children's language skills (Hume, Lonigan, & McQueen, 2015; Scarborough & Dobrich, 1994). Of particular interest was whether oral language skills in FR and NoFR groups developed similarly as a function of variation in these two home-literacy related constructs.

2 | THE RELATIONSHIP BETWEEN BOOK EXPOSURE AND VOCABULARY AND GRAMMAR DEVELOPMENT

Book exposure is a general term used to describe the overall exposure to informal home literacy practices and usually measured by factors such as frequency of parent-child shared reading, number of books owned, access and exposure to literacy materials and visits to the library (Payne, Whitehurst, & Angell, 1994; Phillips & Lonigan, 2009; Sénéchal, 2006; Sénéchal & LeFevre, 2002). Positive effects of book exposure on growth in oral language skills have been widely reported, especially in vocabulary (Deckner, Adamson, & Bakeman, 2006; Farrant & Zubrick, 2013; Schmitt et al., 2011; Sénéchal & LeFevre, 2001; Zhang et al., 2018). It has been suggested that book exposure practices, in particular shared reading, promote word learning by exposing children to more linguistically complex language and varied vocabulary compared to language typically used during regular interactions such as mealtime and playtime (Evans & Shaw, 2008; Montag, Jones, & Smith, 2015). In a meta-analysis, Bus et al. (1995) found that the amount of shared reading explained about 8% of the variance in language and literacy growth of typically developing pre-schoolers. The findings from other meta-analyses have confirmed the significant relationship between book exposure and children's vocabulary development regardless of socioeconomic status (SES; Flack, Field, & Horst, 2018; Mol et al., 2008; Mol, Bus, & de Jong, 2009). Furthermore, there is evidence that HLE has stronger effects on children's oral language skills early in development when various language skills are emerging than later when children are 4–5 years old and beyond, suggesting that earlier home-based literacy interactions might be relatively more influential (Mol et al., 2008; Rodriguez & Tamis-LeMonda, 2011).

A number of studies, however, have failed to find a relationship between book exposure and the development of lexicon, showing that parent report of reading-related activities do not predict language outcomes (Aram, 2006; Debaryshe, 1995; Dodici, Draper, & Peterson, 2003; Evans, Shaw, & Bell, 2000; Roberts et al., 2005; Weigel, Martin, & Bennett, 2006). For example, in interpreting their null finding, Evans et al. (2000) contend that parent-child shared reading, which is not coached (e.g., in dialogic book reading style), does not significantly advance vocabulary over and above everyday experiences and discourse in typically developing children. In a similar vein, a recent meta-analysis (Noble et al., 2019) found only a small overall effect of shared reading on typically developing children's language skills, and this effect was negligible in studies with active control groups and near zero with follow-ups.

Studies on the relationship between book exposure and grammar are not only fewer but also provide less consistent findings than studies on the relationship between book exposure and vocabulary (Grolig et al., 2019; Noble, Cameron-Faulkner, & Lieven, 2018). Some studies failed to find a significant relationship between book exposure and grammar (Debaryshe, 1993; Roberts et al., 2005; Scarborough & Dobrich, 1994; Sparks & Reese, 2013). However, it has also been proposed that exposure to books provides children with models of contextually clear morphology together with complex sentence patterns, and therefore promotes grammatical processing (Cameron-Faulkner & Noble, 2013; Sénéchal et al., 2008). In support of this proposition, results from Grolig et al. (2019) study revealed that pre-schoolers' book exposure was a unique predictor not only of vocabulary but also of grammar. Likewise, in their study, Sénéchal et al. (2008) showed that shared reading accounted for unique variance in expressive vocabulary and morphological knowledge in 4-year-old-children. However, shared reading failed to predict syntactic knowledge. Interestingly, it was parent's own level of literacy that explained unique variance in children's syntax skills. This result points to the possibility that the link between home literacy activities and grammar can be instead genetically mediated due to the fact that parents and children not only share aspects of environment but also genes. Indeed, there is evidence that whereas vocabulary tends to be driven more by shared environment, syntax is driven more by genes in the first years of life; however, genetic factors associated with both language skills become increasingly more influential than environmental factors across development (Hart et al., 2009; Hayiou-Thomas, Dale, & Plomin, 2012; Mimeau et al., 2018). In line with this evidence, a scientific report by the National Center for Family Literacy (2008), which has synthesized the data on early literacy development concluded that exposure to books had less impact on grammar than on vocabulary.

3 | CHILD INTEREST IN BOOK READING AND VOCABULARY AND GRAMMAR SKILLS

Child's interest in reading generally refers to enjoyment and frequency of participation in specific activities related with books (Baroody & Diamond, 2013). Fewer studies have examined the impact of reading interest on pre-school children's language and literacy acquisition (Hume et al., 2015; Sparks & Reese, 2013) in comparison with research considering the role of informal literacy interactions in language development. A review by Scarborough and Dobrich (1994) estimated that child interest could account for about 14% of the variance in language and literacy outcomes, suggesting that individual differences in interest in book reading may also contribute to language development. However, the relationship between children's reading interest and oral language skills is not clear, with some studies finding that there is a link (Bracken & Fischel, 2008; Crain-Thoreson & Dale, 1992; Deckner et al., 2006; Lonigan, Anthony, & Burgess, 1995), whereas other studies failing to do so (Frijters et al., 2000; Roberts et al., 2005; Sénéchal, LeFevre, Thomas, & Daley, 1998; Sparks & Reese, 2013; Weigel et al., 2006). For example, Deckner et al. (2006) showed that children's interest at age 27 months was significantly associated with expressive language at 30 months. Similarly, Crain-Thoreson and Dale (1992) found that the level of interest in reading at age 2 years predicted expressive vocabulary and syntactic comprehension in children 6 months later. Bracken and Fischel (2008) also found a positive correlation between children's reading interest and receptive vocabulary skills at 4;6 years. However, the predictive value of reading interest was not significant, when parent's education and parent-child reading interaction were taken into account. In their longitudinal study, Roberts et al. (2005) showed that child interest in book reading was not significantly related to expressive and receptive language in children at kindergarten entry (age 5 years). Likewise, interest in books was not associated with either receptive or expressive vocabulary in Sparks and Reese's (2013) study. Differences between findings could be due, in part, to the variability in the measures used to assess children's interest in reading-related activities (e.g., parent-report: Bracken & Fischel, 2008; Roberts et al., 2005; child-report: Frijters et al., 2000; direct observation: Deckner et al., 2006). That said, an interesting point to note here is that many of these studies, despite focusing on different age ranges, have provided evidence for a positive link between children's level of exposure to books and their interest in book reading (e.g., Bracken & Fischel, 2008; Crain-Thoreson & Dale, 1992; Hume et al., 2015; Roberts et al., 2005; Sénéchal et al., 1998; Weigel et al., 2006). This suggests that these two constructs may be developmentally related with one another.

4 | THE ROLE OF HOME LITERACY ENVIRONMENT IN FR CHILDREN'S ORAL LANGUAGE SKILLS

Dyslexia is widely recognized as a complex multi-factorial language based disorder with numerous genes implicated that interact not only with one another but also with the environment (Bishop, 2009; Pennington, 2006). The prevalence of dyslexia is considerably elevated in children with a first-degree relative with reading problems (Pennington & Lefly, 2001; Snowling & Melby-Lervåg, 2016). Research on FR children has shown that despite having impairments primarily in the phonological domain, these children, as a group, tend to score lower than their NoFR peers on tasks assessing wider oral language skills, including vocabulary and grammar, in the pre-school years (e.g., Caglar-Ryeng, Eklund, & Nergård-Nilssen, 2019; Gallagher, Frith, & Snowling, 2000; Lyytinen & Lyytinen, 2004; van Viersen et al., 2018). Compared to their typically developing peers, the potential effects of home literacy-related factors on FR children's oral language skills have been investigated to a lesser extent (Hamilton, Hayiou-Thomas, Hulme, & Snowling, 2016; Snowling & Melby-Lervåg, 2016). In an early study, Scarborough, Dobrich, and Hager (1991) reported that FR children, who were later diagnosed with dyslexia, were read to less frequently by their parents in the pre-school period, compared to at-risk children who did not develop reading problems. Scarborough et al. (1991) further reported that when they were 3- and 4-year-olds, FR children, who turned out to be poor readers, were less likely to look at books alone than FR children who became normal readers. However, other longitudinal studies that compared early HLE of FR children with and without dyslexia found no difference between these

children in terms of frequency of shared reading, access to print materials, interest in book reading or library membership, indicating that factors impacting on the outcome of dyslexia are less likely to be environmental in origin (Elbro et al., 1998; Torppa, Eklund, van Bergen, & Lyytinen, 2011; van Bergen et al., 2011; van Bergen et al., 2014).

In a similar vein, a series of studies conducted with Finnish-speaking FR and NoFR children reported no differences between the two groups in terms of their interest in shared reading measured at age 14 months (Laakso, Poikkeus, & Lyytinen, 1999) and 24 months (Laakso, Poikkeus, Eklund, & Lyytinen, 2004). Moreover, early interest in books similarly predicted FR and NoFR children's language at age 18 months (the language score here was a composite of receptive and expressive vocabulary and grammar). However, shared reading at 24 months appeared to predict children's global language score at age 3;6 years only in the NoFR group, suggesting that children with and without family risk might benefit differently from early experiences with books, and that at-risk children may require a longer period of exposure in order to show the benefits (Laakso et al., 2004). However, another study conducted on the same sample between the ages of 2 and 6 years found that although there were no group differences in reading interest or in other aspects of the HLE, the associations of shared reading with children's reading interest and vocabulary skills were stronger in the FR group (Torppa et al., 2007).

Likewise, Hamilton et al. (2016) showed that storybook exposure at the age of 4 years predicted oral language (a composite score of vocabulary and grammar) at age 5 years in English-speaking children with and without a family risk of dyslexia. However, in contrast to previous research (e.g., Elbro et al., 1998; Torppa et al., 2007), Hamilton et al. found less exposure to books in FR children compared to their NoFR peers. The authors argued that because storybook reading varies with family SES, this observed difference might be due to the lower SES of the FR families compared to the NoFR families. The similar level of parental education (an index of SES) in FR and NoFR families in earlier studies might thus have led to differing results. Interestingly, a longitudinal study on FR children by Puglisi, Hulme, Hamilton, and Snowling (2017) found that while variation in book exposure at age 4;6 years was a significant predictor of children's language skills 1 year later, controlling for maternal language ability removed this effect. On this background, Puglisi et al. (2017) proposed that parental language skills, rather than shared reading per se, may have the causal effect on child language development and that the informal HLE could be interpreted as a proxy for genetic effects.

In summary, although several studies have examined the potential importance of various aspects of HLE and child's own interest in reading for language development in both at-risk and typical children, the extant literature is not conclusive. Moreover, since most research addressing this issue has a focus on vocabulary rather than grammar skills, examining whether book exposure and reading interest have a similar impact on these two language constructs may inform our understanding of the association between HLE and language development. In the present study, we investigated whether interest in reading and the amount of book exposure predicted variation in vocabulary and grammar in Norwegian-speaking FR and NoFR children, respectively. Our research questions were as follows:

- 1 Do children with and without a family risk for dyslexia differ in their book exposure or interest in reading at age 4 years? Some studies (e.g., Dilnot et al., 2017; Hamilton et al., 2016) suggest significant differences in HLE experienced by FR and NoFR children due to different socio-economic backgrounds. In line with this, studies comparing FR and NoFR children with similar socio-economic backgrounds find no differences in HLE (e.g., Elbro et al., 1998; Torppa et al., 2007). In the present study, FR and NoFR families did not differ in terms of their household income, and FR and NoFR mothers had a similar level of maternal education. Therefore, we did not expect to find any between-group differences in book exposure or interest in reading.
- 2 Does family risk, book exposure and child's own interest in reading, respectively, have an effect on expressive vocabulary and expressive grammar at age 6 years? If so, does book exposure and interest in reading have different effects in children with and without family risk of dyslexia? On the basis of prior research (e.g., Gallagher et al., 2000; Lyytinen & Lyytinen, 2004; van Viersen et al., 2018), we anticipated lower scores in the FR group compared to the NoFR group. We also hypothesized that book exposure rather than reading interest might influence vocabulary (e.g., Sénéchal & LeFevre, 2002; Torppa et al., 2007), but not grammar skills (e.g., National Center for Family Literacy, 2008; Sparks & Reese, 2013). Furthermore, based on earlier findings (e.g., Mol et al., 2008; Rodriguez & Tamis-LeMonda, 2011) that book exposure has a stronger impact on early rather than later oral

language skills in typical children aged 4 years and over, we expected that book exposure would not predict variation in NoFR children's language skills at age 6. Due to earlier findings (Laakso et al., 2004) that FR children, as a group, require greater exposure to books to show the benefits, we hypothesized that book exposure might predict variation in FR children's vocabulary skills at age 6 years.

- 3 In the case of an effect of book exposure or child's interest in reading on expressive vocabulary and expressive grammar at age 6 years, would this be fully mediated by the 4;6-year language skill (expressive vocabulary and expressive grammar, respectively)? To our knowledge, this has not been studied in at-risk children earlier. We thus made no a priori hypothesis on the possible mediating effects of earlier skills.

5 | METHOD

5.1 | Participants

All 52 children reported here are participants in the Tromsø Longitudinal Study of Dyslexia (TLD). They were monolingual Norwegian, had no known neurological conditions and had scored above 85 on a cognitive scale at age 24 months (Bayley, 2006).

The families were recruited from the arctic region of Norway via advertisements in local newspapers and brochures at local child health clinics. The families were selected in a three-stage procedure. In stage 1, parents who volunteered to participate in the study completed a short questionnaire. The questionnaire asked whether the parent had ever experienced reading and spelling problems and whether close relatives (i.e., their own parents and siblings) had experienced such problems (on a yes/no scale). In stage 2, parents were invited to a semi-structured interview. A detailed questionnaire was mailed to the parents before the interview. Parents who reported current impairments and/or a history of reading and writing impairments were asked to give a more detailed description in the interview. In stage 3, all parents were tested on a battery of literacy tests to validate their self-reported reading and spelling abilities (see Nergård-Nilssen & Hulme, 2014, for a more detailed description of the tests and procedures employed).

5.1.1 | Family risk (FR) group

Children were classified as being at FR if one of the parents met the two following criteria: (a) parent performed below -1 standard deviation on a composite score of standardized measures of reading fluency and spelling, (b) parent self-reported a history of literacy problems. Twenty-eight children (10 girls, 18 boys) met these two criteria.

5.1.2 | No-family risk (NoFR) group

Children whose parents performed within normal range on standardized tests of reading fluency and spelling, and had no self-reported history of reading problems, were allocated to the no-family risk group. Twenty-four children (10 girls, 14 boys) met these criteria.

5.2 | Parent characteristics

Table 1 displays demographic variables and characteristics for FR and NoFR-parents at the beginning of the study. All parents were monolingual, native speakers of Norwegian. There were no significant group differences in terms of age, total household income, or performance IQ.

6 | MEASURES

6.1 | Home literacy environment (age 4)

The HLE was assessed via parental questionnaire when the children were 4 years old. In keeping with previous research (e.g., Puglisi et al., 2017; Sénéchal & LeFevre, 2002; Torppa et al., 2007), the questionnaire included questions about the various aspects of literacy related activities (e.g., parent–child shared reading, number of book at home, visits to library) and the children's interest in book reading. Nine items measuring informal literacy experiences were selected to construct the variable *Book exposure*, and four items assessing child's engagement with books were used to construct the variable *Interest in book reading*.

6.1.1 | Book exposure

To create a composite score of book exposure, we used parental report of the following components of the HLE: frequency of shared reading, parent as a role model for reading, access to books and number of books in the home. Three items assessed the frequency with which parents read to their child at bedtime and at other times, and responses to these items were rated on an 8-point scale, where 1 indicated *never* and 8 indicated *several times during the day/evening*. The role of parent as a model for reading was assessed with the item, "How often does your child see you reading to yourself?", and parents responded to it using a 7-point scale, where 1 indicated *never* and 7 indicated *very often*. Three items about how often parents (a) borrow children's books from the library, (b) buy books for their child and (c) go to the library with the child were used to measure children's access to books, and responses to these items were given on a 7-point scale, where 1 indicated *never* and 7 indicated *very often*. Finally, parents were asked to estimate (a) the number of books on an 8-point scale from 1 (*none*) to 8 (>121) and (b) the number of children's books on an 8-point scale from 1 (*none*) to 8 (>31) they had in the home. Book exposure composite was calculated by using the mean of these nine item scores. Cronbach's alpha reliability for this composite score was .72.

6.1.2 | Interest in book reading

Parents were asked to rate their child's interest in books and book reading by responding to four items in total. Three of these items assessed the frequency with which their child (a) browses books, (b) brings a book and looks at the

TABLE 1 Demographic variables of the parents at the beginning of the study

	No-FR parents		FR parents		t	df	p	Effect size Cohen's d
	Mean	SD	Mean	SD				
Total household income	2.50	1.11	2.31	1.11	0.53	45	.597	0.18
Mothers								
Age	32.74	5.38	31.07	3.77	1.06	47	.295	0.34
Performance IQ	117.58	10.75	118.82	11.05	0.05	42	.825	0.11
Fathers								
Age	34.61	5.27	35.57	6.31	−0.54	45	.591	0.17
Performance IQ	120.21	10.00	121.20	11.13	0.25	37	.622	0.09

Note: Performance IQ was assessed by Wechsler Abbreviated Scale of Intelligence (Ørbeck & Sundet, 2007; Wechsler, 1999). Household's total income in Norwegian Krone (NOK) is indexed by 1 = less than NOK 600,000; 2 = between NOK 600,000 and 700,000; 3 = between NOK 700,000 and 900,000; and 4 = NOK 900,000 or more. Abbreviations: FR, family risk of dyslexia; NoFR, no family risk of dyslexia; SD, standard deviation.

pictures and so forth on her/his own, (c) chooses the book that the parent will read to her/him, and responses to these items were given on a 7-point scale, where 1 indicated *never* and 7 indicated *very often*. In addition, parents were asked to report to what extent they would agree with, "My child likes to play with books," and responses to this item were given on a 5-point scale from 1 (*strongly disagree*) to 5 (*strongly agree*). The mean of these four item scores was used to calculate the composite of interest in book reading. Cronbach's alpha reliability for this composite score was .71.

6.2 | Language measures (age 4;6)

Four subtests from *The Clinical Evaluation of Language Fundamentals-4* (CELF-4; Semel, Wiig, & Secord, 2003; Norwegian adaptation by Monsrud & Rygvold, 2013) were administered to the children to measure their vocabulary and grammar knowledge at age 4;6. The *Expressive Vocabulary* subtest, labelled "Expressive Vocabulary 4;6," was taken to evaluate the children's ability to name illustrations of people, objects and actions (i.e., referential naming). Reliability for this subtest is $\alpha = .82$ (Monsrud & Rygvold, 2013). The *Word Structure* subtest was used to evaluate the children's knowledge of grammatical rules in a sentence-completion task. Here, the child completes an orally presented sentence that pertains to an illustration, and is required to apply targeted word structure rules such as inflections and derivations. Reliability for this subtest is $\alpha = .78$ (Monsrud & Rygvold, 2013). The *Formulated Sentences* subtest was used to evaluate the ability to formulate compound and complex sentences when given grammatical (semantic and syntactic) constraints. Here, the child was asked to formulate a sentence, using target words or phrases, while using an illustration as a reference. Reliability for this subtest is $\alpha = .94$ (Monsrud & Rygvold, 2013). The *Recalling Sentences* subtest was used to evaluate the ability to recall and reproduce sentences of varying length and syntactic complexity. Here, the child imitates sentences presented orally by the examiner. Reliability for this subtest is $\alpha = .89$ (Monsrud & Rygvold, 2013). The *Word Structure*, the *Formulated Sentences* and the *Recalling Sentences* scores were standardized and then combined into a composite score labelled "Expressive Grammar 4;6." Cronbach's Alpha reliability for this composite score is .68.

6.3 | Language measures (age 6)

Four subtests from *CELF-4* were used at age 6. The subtest *Expressive Vocabulary*, labelled "Expressive Vocabulary 6," was re-administered to measure children's vocabulary skills. The subtests *Word Structure*, *Formulated Sentences* and *Recalling Sentences*, were re-administered to assess children's expressive grammar skills. The scores from these three subtests were standardized and then combined into a composite score labelled "Expressive Grammar 6." Cronbach's Alpha reliability for this composite score is .81.

6.4 | Research design and general procedure

The TLD project employs a repeated-measures design. That is, children in the two groups undergo the same tests and procedures over a number of occasions. All children were tested individually at ages 4;6 and 6 years, ± 3 weeks. Assessments were administered in a laboratory at the university and were videotaped and audio-recorded for later analyses. Each session lasted 2–3 hr and was completed with one examiner and one parent in the room (i.e., up to the age of 4;6 years).

7 | RESULTS

Descriptive statistics for the FR group and the NoFR group in mother's education, children's age, book exposure, interest in book reading and language skills at ages 4;6 and 6 years are presented in Table 2. The HLE data included

in the analyses are based on the mothers' responses to the parental questionnaire. This is due to the lower response rate of fathers (54%) compared to mothers (89%). Distributions were inspected within the whole sample, and separately in the FR and NoFR group. All distributions were normal or close to normal and no outliers were detected. No differences were found in mother's education or children's age related to the date of mother's reports of child's book exposure and interest in book reading. Children without family risk for dyslexia outperformed children with family risk in both expressive vocabulary and expressive grammar at 4;6 and 6 years. Effect size between the two groups was large in 6-years expressive grammar and moderate in all other comparisons.

To answer the first research question, whether children with and without family risk for dyslexia differ in their book exposure or interest in book reading at age 4, two independent-samples t-tests were conducted. No differences were found between the FR and the NoFR group in children's book exposure or interest in book reading and the effect sizes between the two groups were small (see Table 2).

Next, to examine the associations between mother's educational level, parent-reported book exposure and child's interest in book reading and language outcomes, Pearson correlations were inspected separately for the FR and the NoFR groups (see Tables 3 and 4). First, mother's education was significantly associated with book exposure, but only in the FR group. No significant associations were found in either group between mother's education and language outcomes at neither 4;6 nor 6 years of age. Second, in both groups, book exposure was significantly associated with child's interest in book reading, and these correlations were moderate to strong. Moreover, neither book exposure nor child's interest in book reading was significantly associated with expressive vocabulary or expressive grammar at 4;6 or 6 years. However, in the FR group book exposure had positive while non-significant correlation coefficients to expressive vocabulary (.27 and .38, at 4;6 and 6 years, respectively), whereas in the NoFR group, the

TABLE 2 Ranges, means and standard deviations of mother's education, children's age, book exposure, interest in book reading and expressive vocabulary and expressive grammar at 4;6 and 6 Years

	Range	FR <i>n</i> = 24–28		NoFR <i>n</i> = 20–24		<i>t</i> ^a	Effect size ^b
		M	SD	M	SD		
Mother's education	1.00–4.00	3.07	0.90	3.29	0.69	0.98	0.27
Child's age at mother's reports	3.54–4.90	4.16	0.39	4.19	0.24	0.31	0.09
Age 4 years							
Book exposure ^c	3.44–6.78	5.50	0.91	5.23	0.89	–0.98	0.30
Interest in book reading ^c	3.50–6.50	5.49	0.85	5.61	0.67	0.53	0.16
Age 4;6 years							
Expressive vocabulary	3.00–12.00	6.92	2.38	8.30	2.12	2.11*	0.61
Expressive grammar ^d	–1.63–1.82	–0.25	0.81	0.25	0.87	2.02*	0.60
Age 6 years							
Expressive vocabulary	3.00–16.00	10.62	2.84	12.23	2.19	2.33*	0.63
Expressive grammar ^d	–2.16–1.48	–0.24	0.86	0.53	0.64	3.43**	1.02

Note: Educational level (1 = compulsory school (year 1–10); 2 = upper secondary school/high school (year 11–13); 3 = bachelor's degree; 4 = master's degree and/or PhD).

Note: **p* ≤ .05, ***p* ≤ .01.

Abbreviations: FR, family risk of dyslexia; M, mean; NoFR, no family risk of dyslexia; SD, standard deviation.

^aDegrees of freedom was 44 in group comparisons related to child's age, book exposure and interest in book reading, 45 in expressive vocabulary and expressive grammar and 50 in mother's education.

^bEffect sizes were estimated with Cohen's *d* (computed with pooled standard deviations).

^cBook exposure and Interest in book reading are mean composite scores from nine and four items, respectively.

^dExpressive grammar (4;6 years) as well as expressive grammar (6 years) are average means from three standardized test-scores.

respective correlation coefficients were also non-significant, but negative ($-.20$ and $-.28$, at 4;6 and 6 years, respectively). The Difference test based on Fisher's z-transformed correlation coefficients (McNemar, 1969) confirmed that the difference between the FR and the NoFR groups in this association was close to significant at age 4;6 years ($p < .06$) and significant at age 6 years ($p < .01$).

To answer the second research question, to what extent family-risk status, book exposure and child's interest in book reading explain the variability in expressive vocabulary and expressive grammar at age 6 years, and whether FR-status serves as a moderating factor in these associations, hierarchical linear regression analyses were conducted. Expressive vocabulary and expressive grammar were used as the dependent measures, each at a time. Due to the small sample size, the effect of book exposure and child's interest in book reading were analysed separately, resulting in altogether four separate analyses (see Table 5). Mother's education was entered into the model as the first step to covariate its effect. Family-risk status was added as the second step, and book exposure/child's interest in book reading as the third step. Finally, to test whether the effect of book exposure/child's interest in book reading was different in the FR and the NoFR groups, a group \times book exposure/group \times child's interest in book reading–interaction measure was added into the model as the fourth step. The model including mother's education, family-risk status, book exposure and the interaction-term group \times book exposure explained 22% of the variability in expressive

TABLE 3 Pearson correlations between mother's education, book exposure, interest in book reading and expressive vocabulary and expressive grammar at 4;6 and 6 years in the FR group

	2.	3.	4.	5.	6.	7.
1 Mother's education	.38*	.18	-.02	.15	.10	-.11
2 Book exposure, 4 years		.49*	.27	.18	.38	.05
3 Interest in book reading, 4 years			.25	-.04	-.03	-.13
4 Expressive vocabulary, 4;6 years				.68***	.51**	.56**
5 Expressive grammar, 4;6 years					.52**	.84***
6 Expressive vocabulary, 6;0 years						.50**
7 Expressive grammar, 6;0 years						

Abbreviation: FR, family risk of dyslexia.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

TABLE 4 Pearson correlations between mother's education, book exposure, interest in book reading and expressive vocabulary and expressive grammar at 4;6 and 6 years in the NoFR group

	2.	3.	4.	5.	6.	7.
1 Mother's education	.25	.12	.15	.01	-.01	.03
2 Book exposure, 4 years		.38*	-.20	.06	-.28	.08
3 Interest in book reading, 4 years			-.04	.22	-.14	.39
4 Expressive vocabulary, 4;6 years				.38	.42*	.59**
5 Expressive grammar, 4;6 years					.01	.70***
6 Expressive vocabulary, 6;0 years						.13
7 Expressive grammar, 6;0 years						

Abbreviation: NoFR, no family risk of dyslexia.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

TABLE 5 Summaries of the four hierarchical linear regression analyses predicting expressive vocabulary and expressive grammar at 6 Years

Predictor	Dependent language skill at age 6 years			
	Expressive vocabulary		Expressive grammar	
	ΔR^2	β	ΔR^2	β
Step 1: Mother's education	.01	-0.03	.00	-0.08
Step 2: Family risk status	.11*	-2.22	.19**	-0.46
Step 3: Book exposure	.01	-0.23	.01	0.08
Step 4: Interaction effect family risk status \times book exposure	.10*	1.95	.00	0.01
Total R^2 /adjusted R^2	.22/.14		.19/.10	
Model fit	F(4,36) = 2.59*		F(4,36) = 2.16	
Step 1: Mother's education	.01	0.04	.00	-0.05
Step 2: Family risk status	.11*	-0.73	.19	1.26
Step 3: Interest in book reading	.01	-0.14	.00	0.34
Step 4: Interaction effect family risk status \times interest in book reading	.00	0.40	.05	-1.49
Total R^2 /adjusted R^2	.13/.03		.24/.15	
Model fit	F(4,36) = 1.32		F(4,36) = 2.83*	

Note: Standardized beta-values presented according to the final model with all independent measures included into the model.

* $p \leq .05$.

** $p \leq .01$.

TABLE 6 Summary of the hierarchical linear regression analysis predicting expressive vocabulary at 6 Years when taking into account expressive vocabulary at 4;6 Years

Predictor	Dependent language skill at age 6 years	
	Expressive vocabulary	
	ΔR^2	β
Step 1: Mother's education	.01	-0.08
Step 2: Family risk status	.11*	-1.49
Step 3: Vocabulary at 4;6 years	.22**	0.45
Step 4: Book exposure	.01	-0.14
Step 5: Interaction effect family risk status \times book exposure	.04	1.34
Total R^2 /adjusted R^2	.39/.30	
Model fit	F(5,35) = 4.45**	

Note: Standardized beta-values presented according to the final model with all independent measures included into the model.

* $p \leq .05$.

** $p \leq .01$.

vocabulary at 6 years. The effects of family-risk status and the interaction-term group \times book exposure were significant, whereas the effects of mother's education and book-exposure were not. Having family-risk for dyslexia resulted in lower level of expressive vocabulary at 6 years. On the other hand, high book exposure increased the

expressive vocabulary at 6 years, but only in the FR group. The effect of child's interest in book reading on expressive vocabulary at 6 years was non-significant. When predicting the variability in expressive grammar at 6 years, family-risk status was the only significant predictor explaining 19% of its variance. Having family risk resulted in lower level of expressive grammar at age 6 years.

Finally, to test whether expressive vocabulary at 4;6 years fully mediated the effect of book exposure in the FR group, an additional hierarchical regression analysis was conducted (see Table 6). The 4;6-year expressive vocabulary was entered into the model as the third step, book exposure as the fourth step and the interaction-term group \times book exposure as the fifth step. The model including mother's education, family-risk status, book exposure, expressive vocabulary at 4;6 years and the interaction-term group \times book exposure explained 39% of the variability in expressive vocabulary at 6 years. Family-risk status and expressive vocabulary at 4;6 years were the only significant predictors of expressive vocabulary at 6 years. The effect of the interaction-term group \times book exposure was no longer significant suggesting that expressive vocabulary at 4;6 years fully mediated its effect on expressive vocabulary at 6 years.

8 | DISCUSSION

This longitudinal study was undertaken to investigate whether amount of book exposure and interest in reading were different in samples of Norwegian FR-children and NoFR-children. We further investigated whether these home literacy-related factors at age 4 years exerted different effects on vocabulary and grammar skills at school entry age (i.e., 6 years) depending on family-risk status, and whether they made an independent contribution to language outcomes at age 6, after controlling for the 4;6-year language skills. Our findings add to the existing literature in three ways: First, we found no significant differences between FR children and their NoFR-peers in terms of book exposure and interest in reading. Second, our study showed that interest in book reading did not have an impact on vocabulary and grammar in either group. On the contrary, book exposure increased vocabulary skills, however only in the FR group. Third, our findings showed that when early vocabulary knowledge was taken into account, the interaction effect suggesting a positive influence of book exposure on FR children's later vocabulary was no longer significant.

As expected (Gallagher et al., 2000; Lyytinen & Lyytinen, 2004; van Viersen et al., 2018), the present sample of FR children had poorer vocabulary and grammar skills at ages 4;6 and 6 years. However, the FR and NoFR children did not differ significantly in the amount of book exposure and interest in reading. While aligning well with the findings from earlier prospective studies (Elbro et al., 1998; Torppa et al., 2007; van Bergen et al., 2014), the current result contradicts the findings by Hamilton et al. (2016), who found that FR children were less exposed to books than NoFR children were. However, in Hamilton et al.'s study, there were SES-related differences between the families, which were in favour of NoFR families. We assume that the fact that FR and NoFR families in the present study were similar in their SES (as indexed by level of household income and mother's education) might explain why there was no significant difference in children's book exposure. Likewise, our result that maternal education was not correlated with child language outcomes might be affected by the SES backgrounds of the current sample. Because the majority of mothers had completed higher education (i.e., bachelor's degree) in the present study, the lack of correlation between these variables might be due to the restricted range of maternal education in our sample. However, another longitudinal study with a larger sample of Norwegian children reported also that mothers' educational level was unrelated to vocabulary skills in children at ages 5 and 6 years, irrespective of whether mothers had high or low level of education (Karlsen, Lyster, & Lervåg, 2017). As there is evidence that maternal education is a robust predictor of children's language skills (e.g., Bracken & Fischel, 2008; Hoff, 2006), more research in this field is needed to understand the mixed results concerning the role of mother's education in child language development.

In line with earlier research (e.g., Bracken & Fischel, 2008; Hume et al., 2015; Torppa et al., 2007), amount of book exposure and interest in book reading correlated significantly within both groups, indicating a positive link,

regardless of whether children came from families with or without a history of dyslexia. However, the finding that children's own interest in book reading did not predict variations in vocabulary and grammar skills is different from some earlier reports (Crain-Thoreson & Dale, 1992; Deckner et al., 2006; Laakso et al., 2004). For example, Laakso et al. (2004) found that reading interest in typically developing children assessed at 14 and 24 months could predict a composite of global language at age 3;6. Similarly, Crain-Thoreson and Dale (1992) reported that reading interest at age 2 years predicted vocabulary and syntax at 2;6 years. The measure of reading interest that we used was based on parental report, whereas the measures used by Crain-Thoreson and Dale (1992), Deckner et al. (2006) and Laakso et al. (2004) were based on the observation of parent-child shared reading during the laboratory visit, and this might have contributed to the difference in the results. Another important aspect of these studies that may account for the differing results is that both interest in reading and language outcomes were measured much earlier than in the present sample. On the other hand, the insignificant effect of reading interest on subsequent language skills has been reported in several other studies, which included pre-school children aged 4 years and above, (Frijters et al., 2000; Roberts et al., 2005; Sparks & Reese, 2013; Torppa et al., 2007; Weigel et al., 2006). It is noteworthy that these studies with older pre-school children yielded similar results, despite that they employed different measures (e.g., Frijters et al., 2000: child's self-report; Roberts et al., 2005: a single interview question to mothers; the present study: a composite of several parent questionnaire items). Taken together, these results suggest that the extent to which children's interest in reading predicts later broader language development is age-dependent in pre-school years.

The current study failed to show that exposure to books was a unique predictor of expressive vocabulary and grammar skills, which is in agreement with past research (Evans et al., 2000; Roberts et al., 2005; Sparks & Reese, 2013; Weigel et al., 2006). Another noteworthy finding was the significant interaction effect between book exposure and family-risk status. That is, variation in vocabulary skills explained by the amount of book exposure was different depending on whether the children had FR or not. A higher degree of exposure to book reading practices at age 4 appeared to generate higher scores in vocabulary at age 6 years in the FR group, whereas no such effect was found in the NoFR group. This non-existing effect could be due to several reasons. One reason could be that informal home literacy experiences measured at age 4 might lose impact on oral language skills by the end of the pre-school period (age 6). In support of this assumption, empirical evidence from typically developing children suggests that the effects of parent-child shared reading are greater in younger children when vocabulary and grammar skills are in rapid progress, compared to those older than 4 years (Mol et al., 2008; Rodríguez & Tamis-LeMonda, 2011). In addition, as suggested by Evans et al. (2000), it might be that ordinary book reading activities do not significantly advance oral skills in typical children this age, over and above everyday language interactions.

The outcome observed here in the FR group contradicts the findings by Laakso et al. (2004), which showed that book reading activities predicted variation only in NoFR children's vocabulary and grammar at age 3;6. On the other hand, our finding converges with the results of a follow-up study with the same sample, which demonstrated stronger associations between shared reading and vocabulary skills in the FR group before school age (Torppa et al., 2007). Laakso and colleagues argue that children with FR for dyslexia may need a longer period of exposure to books to reap the benefits, and that the potential positive effects may be more evident in some language domains than others. In this light, our finding seems to provide support to this argument by showing that book exposure had a longitudinal effect on vocabulary in the FR group, while it had no effect on grammar skills. The reason for this result might have to do with the argument that grammar to a lesser extent is susceptible to environmental influences than vocabulary is (Hart et al., 2009; Hayiou-Thomas et al., 2012; Mimeau et al., 2018). It might also be that the book exposure measure we used did not capture the dimensions of the HLE, which might be predictive of growth in grammar skills (e.g., the types/genre of books used in shared reading).

Due to the longitudinal design of our study, we could also examine whether the effect of book exposure on FR children's later vocabulary skills (age 6) would be mediated by lexical knowledge at age 4;6 years (i.e., the auto-regressor effect). Our findings suggest that early vocabulary skills, rather than book exposure per se, facilitate the acquisition of lexical skills obtained through informal home literacy activities. To our knowledge, this issue has not been addressed in prior studies of at-risk children. However, it may be argued that FR children with relatively better

early language skills may be able to take greater advantage of home literacy activities, which in turn exerts a positive effect on their subsequent language development. In a similar way, children with stronger initial language abilities may be more likely to elicit a richer HLE, which can indirectly affect later language skills. The child's own role in reading related activities has indeed been emphasized in an earlier study of FR children, in which children who more often engaged in such activities induced their parents to read to them more frequently (Scarborough et al., 1991). Taken together, findings from the present study seem to suggest that informal home literacy practices promoting book exposure contribute to later expressive vocabulary through their effects on early language development; however, based on the current data, we cannot rule out the possibility that there could equally be effects of child language on HLE at play. Thus, future research focusing on this issue is needed to disambiguate these two explanations.

Several limitations of this study must be considered. We first note that the current sample is small. Although our findings comply with previous research, studies with larger samples are needed to replicate them. Second, it should be acknowledged that parents of our participants were primarily from middle-class, well-educated backgrounds. In addition, they had above-average mean scores on the performance IQ assessment, suggesting that the current sample of parents was not necessarily representative of the population. More research including FR and NoFR children coming from families of diverse SES backgrounds is needed to determine the extent to which our findings generalize to other SES groups. Third, the data on book exposure and child's reading interest are based on parental self-reports, which might be affected by social desirability (Debaryshe, 1995). Future research using observational measures would help confirm the current findings. Another limitation pertains to conceptualizing book exposure as a measure. Our study was mainly concerned with the frequency and the amount of informal literacy practices in which children were exposed to books. Therefore, we did not measure the quality of parent-child interactions during reading activities. However, empirical evidence indicates that parents' reading style and use of dialogic techniques, such as providing definitions or asking questions about the story text, might significantly influence oral language skills (Flack et al., 2018; Mol et al., 2008). In a similar vein, certain types of books (e.g., expository books vs. storybooks) are thought to affect lexical and grammatical complexity of parental input differently, which in turn, may have an important effect on children's later language development (Noble et al., 2018). These factors need to be examined in future studies with at-risk children.

In summary, the current study contributes to our understanding of the potential role of HLE on at-risk children's language skills. Our results indicate that variation in the amount of book exposure at age 4 years affects children's vocabulary skills at school entry age (i.e., 6 years) differently depending on whether they come from families with or without a history of dyslexia. High book exposure seems to increase the expressive vocabulary only in the FR group. However, this longitudinal association is completely mediated by language skills at age 4;6 years. That is, FR children with higher levels of lexical skill at earlier ages acquire more vocabulary through exposure to literacy-promoting activities at home than children with lower levels of such skill. Therefore, a stimulating HLE appears to have a positive indirect effect on later language development through its effect on earlier linguistic skills. Our findings can thus be taken to suggest that early intervention (i.e., exposure to various book-reading activities) particularly for pre-school FR children with poor expressive vocabulary knowledge is worth considering, and this issue should be addressed in future research.

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