

Home Literacy Practices for Young Children With Cochlear Implants

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Erin E. Campbell, PhD^{1,2} , Deborah Bervinchak, MA, CCC-SLP²,
Jean Desjardin, PhD³, Kristin Ceh, MEd², Kathleen Lehnert, MS, CCC-SLP²,
Deborah Grammer, MEd, CCC-SLP², and Howard W. Francis, MD, MBA^{1,2}

Abstract

This study investigated relationships among home reading practices, shared book reading (SBR) behaviors, and child literacy outcomes in young children with cochlear implants. Parents ($N=18$) completed a home reading questionnaire and recorded themselves reading books with their children at home. Shared book reading sessions were coded for interactive reading behaviors. Children's early language skills and literacy skills were also assessed. We explored variability in these behaviors with regard to demographic characteristics and type of book; these exploratory analyses revealed that parents used more literacy teaching techniques when reading the wordless picture book and that parent interaction and engagement and literacy teaching techniques were more frequent with younger children than with older children. While many families frequently used interactive reading behaviors, our analysis did not find significant relationships between the parent behaviors and children's literacy scores. However, there was an interaction between the *amount* of reading and cochlear implant experience such that more cochlear implant experience was associated with better reading outcomes *only* for the group of children who received more reading time. In a sample of young children with cochlear implants, reading time, cochlear implant experience, and child language skills were better predictors of reading outcomes than parents' frequency of SBR behaviors alone.

Keywords

3 to 5 years, age, elementary school, deaf/hard of hearing, exceptionalities, family/parent issues, literacy, reading, cochlear implants/hearing aids, technology

Children born Deaf/Hard-of-Hearing (DHH), including those who use cochlear implants, are at risk of persistent delays in reading skills (Easterbrooks & Lederberg, 2021; Traxler, 2000). Despite improvements in technology and earlier diagnosis and intervention (Williams et al., 2015), literacy outcomes vary considerably for young children with cochlear implants (CIs) (Mayer et al., 2021; Mayer & Trezek, 2018; Wang et al., 2021), with many children still not achieving age-appropriate reading abilities (Ambrose et al., 2012; Geers et al., 2008; Ingvalson et al., 2020; Nittrouer et al., 2012).

Early child-level factors may explain some of the variance in children's literacy skills. Some of these factors may be immutable, such as cognitive factors, including nonverbal intelligence (Geers, 2003) and working memory (Geers, 2003; Wass et al., 2019); demographic characteristics, including gender (Geers, 2003) and socioeconomic status (SES) (Connor & Zwolan, 2004; Geers, 2003; Wass et al., 2019); and speech production ability (Geers, 2003; Wass et al., 2019). Others may be potential targets for intervention: for instance, children who receive implants earlier

generally have better literacy skills (Connor & Zwolan, 2004; Geers, 2003).

Moreover, caregivers play a significant role in children's literacy outcomes. Prior research in children with normal hearing (NH) shows that the home literacy environment is a critically important setting for children's literacy development. Specifically, caregivers' *quantity* of shared book reading and *qualitative characteristics* (e.g., parental linguistic and nonverbal input) of interactions with their children during shared book reading (SBR) sessions have been linked with children's literacy abilities. Indeed, frequency of shared book reading in the infant and toddler years predicts emergent literacy skills in preschool, literacy

¹Duke University, Durham, NC, USA

²Johns Hopkins Medical Institute, Baltimore, MD, USA

³Moravian University, Bethlehem, PA, USA

Corresponding Author:

Erin E. Campbell, Department of Psychology & Neuroscience, Duke University, 417 Chapel Drive, Box 90086, Durham, NC 27708, USA.
Email: erin.e.campbell@duke.edu

ability at school-age, and internal motivation to read for young children with NH (Anderson et al., 2019; Araújo & Costa, 2015; Barnes & Puccioni, 2017; Bus et al., 1995; Ece Demir-Lira et al., 2019; Karrass & Braungart-Rieker, 2005; Leseman et al., 2007; Sonnenschein & Munsterman, 2002).

Caregivers can also support children's early literacy through *how* they read and construct children's early linguistic environment. Linguistically rich experiences, including language songs and open-ended questions during SBR, positively influence literacy for children with NH (Evans et al., 2000; Ezell & Justice, 2005; Fernandez-Fein & Baker, 1997; Haney & Hill, 2004; Shah, 2000; National Research Council, 1998). During shared book reading, parents can support later reading success through strategies such as linking the text to children's prior life experiences and actively asking children questions about letters, words, and the story plot (Anderson et al., 2019; Barnes & Puccioni, 2017; Clingenpeel & Pianta, 2007; Ece Demir-Lira et al., 2019).

Home literacy practices appear to be an important factor in determining early reading skills in DHH children as well (DesJardin et al., 2009). Prior work, for example, finds that among DHH children, parents' frequency of book reading and use of specific parent reading behaviors, question-asking in particular, are linked with language and literacy outcomes for young children with hearing loss (Aram et al., 2006; Ceh et al., 2013; DesJardin et al., 2009). Ceh et al. (2013) administered a questionnaire to parents of young children with cochlear implants about their reading behaviors at home and assessed children's language and literacy skills; the authors found that daily reading and the use of open-ended questions during reading were associated with smaller language delays. Aram and colleagues (2006) found that mothers' use of comprehension questions during book reading predicts the phonemic awareness skills of DHH kindergartners to a greater extent than children's age or degree of hearing loss. Similarly, in a group of school-aged children with cochlear implants, mothers' use of open-ended questions and recasts during shared book reading was positively related to children's later phonological awareness and reading skills (word recognition and reading comprehension; DesJardin et al., 2009).

Although these literacy behaviors correlate with better language and literacy outcomes, engaging in supportive, interactive reading behaviors may be more challenging for hearing parents of DHH children. Evidence suggests that DHH toddlers demonstrate less interest in books and reduced involvement in shared book reading with their parents compared with their hearing peers (DesJardin et al., 2017). Consequently, parents of DHH children report greater difficulty engaging their children in shared book reading than parents of hearing children (DesJardin et al., 2017; Reynolds & Werfel, 2020), which raises alarms given that parent-reported child engagement during book reading is also a strong predictor of reading ability in children with

hearing loss (Reynolds & Werfel, 2020). To that end, several intervention studies have attempted to improve the quality of parent-child interactions during a shared book reading in both children with normal hearing (Noble et al., 2020) and children with hearing loss (Dirks & Wauters, 2018; Farquharson & Babeu, 2020), and indeed, such interventions successfully increase parents' use of interactive SBR behaviors.

It is therefore important to better understand the complex relationships among quantity and qualitative characteristics of shared book reading, child factors (e.g., length of implant use), and literacy outcomes in young DHH children with CIs. Using both parent report and observation, this study addressed the following research questions:

Research Question 1 (RQ1): What is the prevalence of literacy-related activities (e.g., parent and child book reading behaviors) in the home reading environment?

Research Question 2 (RQ2): Does the frequency of these activities and behaviors vary with demographic characteristics or with the kind of book being read (with or without words)?

Research Question 3 (RQ3): What combination of child (CI experience, oral language abilities) and parent characteristics (SES, frequency of reading, shared book reading behaviors) best account for variability in children's literacy skills?

Method

Participants

Eighteen parents and their children with cochlear implants participated in the study. Children were recruited through a clinic located in Baltimore, Maryland. The site received Internal Review Board Approval for this study. Inclusion criteria for the children included no known secondary disability, English as the primary language spoken at home, and receiving a cochlear implant prior to their second birthday. In addition, to be eligible for the study, children had to have ≥ 2 years of cochlear implant experience and ≥ 12 months of regular postoperative auditory rehabilitation. Beyond having a child who met these inclusion criteria, no further eligibility requirements were imposed on parents.

Parents. For sixteen of the dyads, mothers completed the study activities; in the remaining dyads, the father participated. All families were two-parent households. Parents in our sample spanned a range of education and income levels, but most parents tended toward higher income and higher education (see Table 1).

Children. As shown in Table 1, the children's mean age at participation was 63.70 months (range: 38 – 102). On

Table 1. Demographic Characteristics of the Sample.

Demographic characteristics	
Child gender	
Female	8
Male	10
Age at study	
Mean (SD)	64 (19.3) months
Range	38–102 months
Age at diagnosis	
Mean (SD)	5 (5.3) months
Range	0–18 months
Age at implantation	
Mean (SD)	15 (4) months
Range	10.3–24 months
Cochlear implant experience	
Mean (SD)	48 (18.6) months
Range	27.1–84.2 months
Cochlear implant side/timing	
Both simultaneously	5
Both sequentially	9
Unilateral	4
Developmental delay	
Yes	2
No	16
Preferred communication	
Spoken English	17
Cued speech	1
Total communication	0
American sign language	0
Gender of participating parent	
Female	16
Male	2
Number of adults in home	
Two-parent household	18
Single-parent household	0
Other family structure	0
Siblings	
Only child	2
Has younger siblings	5
Has older siblings	3
Both younger and older siblings	6
Parental education	
High school/GED	6
Bachelor's degree	6
Graduate degree	6
Family income	
\$25,000–\$49,999	1
\$50,000–\$74,999	2
\$75,000–\$100,000	6
More than \$100,000	9

average, children were identified with hearing loss at 5.40 months, received bilateral cochlear implants at 15.20

months, and had 48.50 months of cochlear implant experience at the time of participation in this study. Two participants were reported to have a developmental delay, but both participants were ultimately retained in the study due to having reading and language scores well within the average range of the participants. All children used spoken English regularly; in addition, one parent reported regularly using cued speech with their child, and two parents reported using American Sign Language (although not as the primary communication strategy). All participants had been enrolled in birth-to-three intervention programs, primarily auditory-oral, and many of the older participants were also enrolled in preschool or early elementary education programs.

Measures

Prior to bringing study materials home, children were administered the Test of Reading Ability 3 (TERA-3) and Oral and Written Language Scales (OWLS-II) in-clinic by rehabilitation specialists (speech-language pathologists and/or educators of the deaf/hard of hearing). In addition, parents completed a self-report home literacy environment questionnaire and provided demographic information.

Test of Reading Ability 3. Early reading abilities were measured by the ¹TERA-3 which consists of three separately administered subtests: Alphabet, Conventions, and Meaning (Reid et al., 2001). The Alphabet subtest consists of 29 items, which are designed to measure alphabet knowledge and sound-letter correspondence. The Conventions subtest is comprised of 21 items and tests children's knowledge of print concepts, such as how to handle a book, print conventions, punctuation, capitalization, and spelling. The Meaning subtest consists of 30 items that measure children's ability to understand words, sentences, and paragraphs. Together, these subtests compute an overall Reading Quotient (RQ), which we used for all analyses. The TERA-3 RQ is normed based on a United States sample of >1,000 children, aged 3;0 to 8;11, and has been used in studies of emergent literacy in children with and without hearing loss (e.g., Ceh et al., 2013; Haney & Hill, 2004; Phillips et al., 2008).

OWLS-II. Children's language skills were evaluated using the Listening Comprehension and Expressive Language scales of the OWLS (Carrow-Woolfolk, 2011). For the Listening Comprehension Scale, the examiner reads a word or phrase aloud and the child responds by pointing to one out of a set of four pictures that best depicts the meaning or the word or phrase. For the Oral Expression scale, the child is instructed to answer questions, finish sentences, and generate sentences in response to visual and oral prompts. Critically, neither of the OWLS scales used required the child to read. The OWLS scales are normed for children 3 to 21 years of age on a nationally representative U.S. sample of

>2,000 children. Standard scores were retrieved from the scoring manual.

Home Literacy Environment Questionnaire. Parents completed a brief self-report questionnaire of twelve home reading behaviors and language/literacy activities. Reading behaviors were selected from frequently used items from previous research on literacy environments for families of young children with and without hearing loss (DesJardin et al., 2011; Evans et al., 2004; Weigel et al., 2006). Questions include: “*I ask who/what/where questions while reading with my child.*” and “*My child sees family members reading for pleasure.*” A 5-point Likert-type scale was used, ranging from 1 (*never*) to 5 (*multiple times during reading sessions*). We discuss the item-level frequency and prevalence below, and a total mean score was used for correlations with Reading Quotient (RQ). In addition, parents were asked four questions designed to measure their self-efficacy (e.g., “*I feel that I can positively affect my child’s ability to express his or her thoughts.*,” “*I feel that I can positively affect my child’s ability to read.*”). Parents responded to the self-efficacy items using a 5-point Likert-type scale ranging from 1 (*not at all*) to 5 (*very much*). This questionnaire is provided in its entirety as a Supplemental File.

Procedures

Shared Book Reading. Parents video-recorded shared book reading sessions for three different books with their children in their homes. Parents were loaned a Flip video camera and instructed to record the book reading sessions in a comfortable, quiet room, with no other distractions (no other people in the room or environmental noise). It was recommended that caregivers choose a time when the child would be fed, well-rested, and able to attend to the stories. Parents could opt to read all three books in one sitting or spread the sessions out over multiple days; descriptively, the latter strategy was more common for younger children. Most of the parents were seated on a carpeted floor or couch in their family rooms, and children were generally seated within 6 inches of the parent. Parents were instructed to read as they would normally do in their home. Two books were provided to each parent–child dyad, a wordless picture book titled, “Wave” (Lee, 2008) and a book with words titled, “Llama Llama Mad at Mama” (Dewdney, 2007). Parents chose a third book familiar to the child.² Similar books have been used in prior parent–child interaction research with NH children (Weizman & Snow, 2001) and children who are Deaf or Hard of Hearing (DesJardin et al., 2014, 2017). Book reading sessions ranged from 8 to 10 min with a mean time of 9.32 min per book. Although no explicit instructions were given regarding communication modality,

all parents completed the book reading sessions primarily in spoken English, with the exception of a handful of isolated signs (e.g., BOOK).

Data Preparation. The shared book reading sessions were coded for the frequency of shared book reading behaviors using an adapted version of a published protocol consisting of 11 items (DesJardin et al., 2011). The first author and four listening and spoken language professionals, including teachers of the deaf and speech-language pathologists, were trained to use the protocol and to tally the number of times that each parent or child behavior occurred for each dyad for each book. Words that parents read directly from the book were not counted (e.g., if the text of the book said “*Where’s Spot’s ball?*,” this would not count toward the number of prediction questions). Reliability for the five raters for each coded behavior was computed by intraclass correlation and ranged from 0.54 to 0.91, indicating moderate to excellent reliability. To conserve power for statistical analyses, the 11 behaviors from the videos were grouped into three categories: (a) Parent Engagement and Interaction (*When off-task, parent makes efforts to redirect attention to book; parent responds to book-related child utterances verbally or nonverbally; parent elaborates the story by verbally explaining, adding intonation/expression, or using gestures, to help define vocabulary and/or concepts; parent pauses for 5 secs to encourage child engagement/response*); (b) Child Engagement and Interaction (*Child is on-task and engaged/attentive.; child responds to parent’s questions*), and (c) Literacy Teaching Techniques (*Parent monitors comprehension by asking questions; parent relates content of book to prior experience; parent solicits predictions; parent adds syntactic/grammatical structures to child’s utterance.; parent uses “book language”*). A total score for each category was computed and used in the analyses predicting RQ.

Results

Children’s Language and Reading Skills

Children’s oral language ability ranged from 53 to 117 (OWLS standard scores), with a mean score of 87.28 (*SD*: 13.02). Five children (28% of the sample) scored below one standard deviation of the mean (standard score < 85). Children’s reading quotient (TERA-3 standard score) ranged from 74 to 117, with a mean score of 90.28 (*SD*: 12.13). Six children (33% of the sample) scored below one standard deviation of the mean (standard score < 85). Pearson’s product–moment correlation shows that reading quotient and oral language scores are tightly correlated ($r = .57, p = .014$). Children’s reading quotient and oral language scores did not vary by gender, parent education, or household income (all $ps > .05$ via Kruskal–Wallis test).

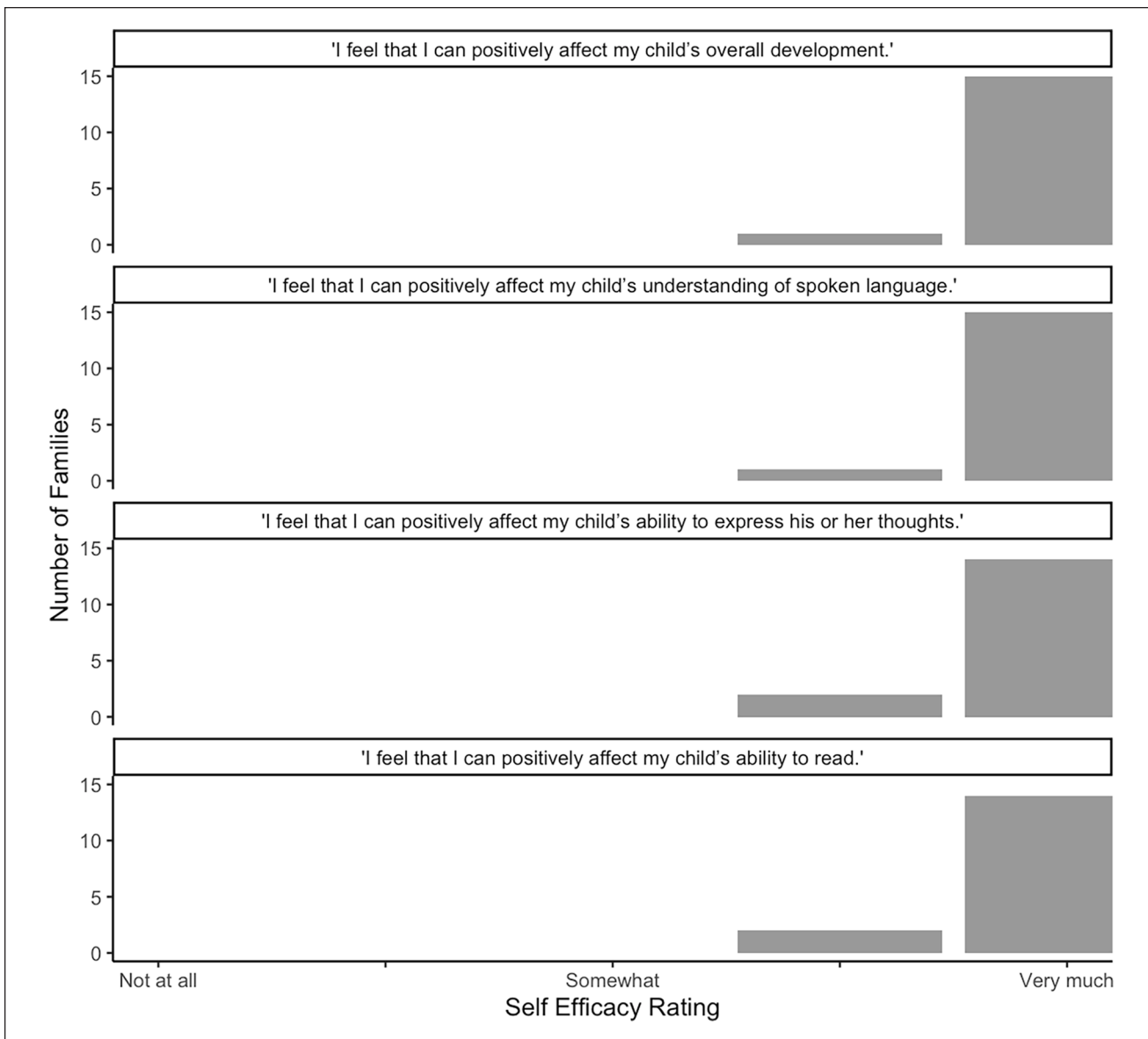


Figure 1. Parental Self-Efficacy Ratings are Reported on the Questionnaire.

Note. Distribution of parent self-efficacy ratings from the Home Literacy Environment Questionnaire: 1—not at all; 3—somewhat; 5—very much.

Qualitative Reading Experiences and Attitudes

Across the board, parents reported a high, positive sense of their ability to positively influence their children’s language, literacy, and overall development. These self-efficacy data are not analyzed further due to low variability in parent ratings; see Figure 1. During the video-recorded sessions, children were engaged and attentive for 87% of the SBR session on average. These observations suggest an overall positive experience of shared book reading for parent–child dyads.

Prevalence of Home Literacy Activities and SBR Behaviors

To address our first research question, we analyzed the parent questionnaire and shared book reading videos for the frequency and prevalence of parental reading practices. Turning first to the questionnaire (see Figure 2), the frequency was defined as the mean frequency rating for each item, and prevalence was defined as the proportion of parents rating the behavior as “sometimes,” “often,” or “always” (ratings of ≥ 3). The most frequent practice was “I vary the

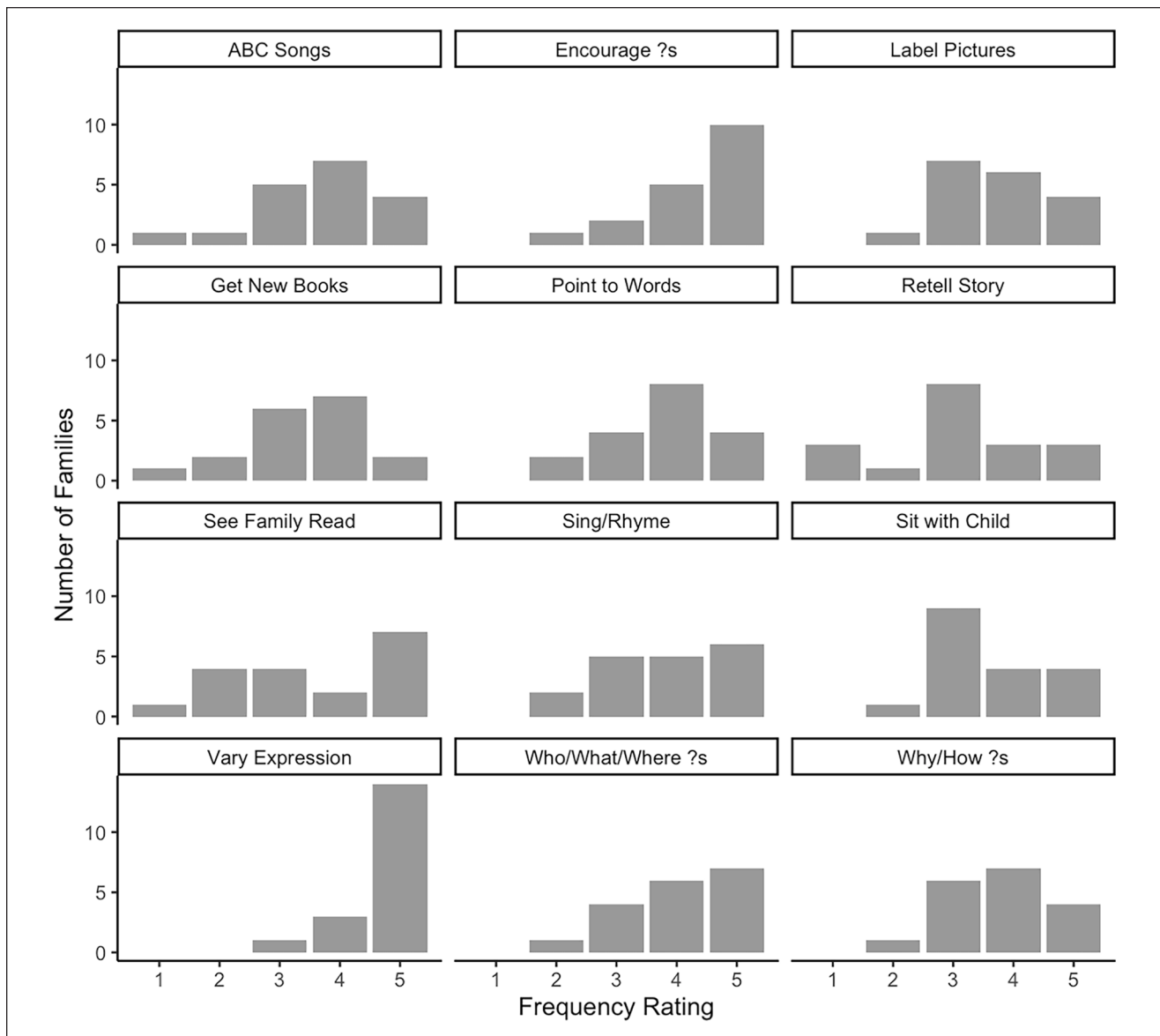


Figure 2. Frequency of Parent-Reported Home Reading Practices.

Note. Frequency ratings for each item on the parent questionnaire: 1—not at all; 3—four times a week; 5—everyday.

expression in my voice or tone to fit the story when I read aloud to my child.” ($M: 4.72$), which was also the most prevalent with 100% of families reporting regularly using this strategy. The least frequent parent practice was “*I retell the story by adjusting the story line to my child’s language level.*” (mean: 3.11), and the least prevalent was “*My child sees family members reading for pleasure.*,” with 72% of families reporting this as a regular occurrence.

We further explored the frequency and prevalence of SBR behaviors in the reading session videos (see Table 2). In the videos, the frequency was defined as the number of times a behavior occurred, averaged across books for each family. Prevalence was defined as the proportion of families

observed to use a given behavior in the SBR sessions. Several behaviors were used by all parents: “*Parent monitors comprehension by asking questions,*” “*Parent relates content of book to prior experience,*” “*Parent responds to book-related child utterances,*” “*Parent elaborates the story by verbally explaining, adding intonation/expression, or using gestures to help define vocabulary and/or concepts,*” “*Parent uses book language.*” However, the most frequent observed parent behaviors included “*Parent responds to book-related child utterances*” (Parent Engagement and Interaction), which occurred on average 282 times per family across the three books ($SD: 18.0$) and “*Parent elaborates the story by verbally explaining, adding*

Table 2. Frequency of SBR Behaviors During Reading Sessions.

Behavior	Range	Mean (SD)
Parent Engagement & Interaction		
Parent responds to book-related child utterances verbally or nonverbally (comments, answers questions, nods, smiles, leans in and looks at child).	222–300	282 (18)
Parent elaborates the story by verbally explaining, adding intonation/expression (“BIG” said with a big voice), or using gestures, to help define vocabulary and/or concepts. Information added is beyond: e.g. “cow is tired and going to sleep in the barn.” Child <i>does not</i> have to initiate this parent behavior by verbalizing.	117–300	258 (44.4)
Parent pauses for 5 secs to encourage child engagement/response.	0–6	0.6 (1.5)
Child Engagement & Interaction		
Child is on-task and engaged/attentive; did not need redirection.	73–100%	92% (10.1%)
Child responds to parent’s question within 1–2 seconds.	6–69	30 (18)
Literacy Teaching Techniques		
Parent monitors comprehension by asking questions (Who, What, Where, When, Why, How)	27–186	83.4 (46.8)
Parent solicits predictions (“What do you think will happen next?” “What do you think the story is about?” “What would you do?”)	0–57	3 (13.8)
Parent relates content of book to prior experience (“Look there is a dog just like our dog!”, “Do you do that?”, “Do you get mad?”, “we went to the zoo, remember?”)	0–6	3 (1.5)
Parent simply adds syntactic/grammatical structures to child’s utterance in order to provide a correct model of more complex sentence using child’s intent based on child’s language level. (E.g. child says “cow sleep”, parent models “the cow is sleeping”; For young children may be simply “It’s a cow” if child says “cow”)	0–132	33 (36.3)
Parent uses “book language” (“the author is..”, “the illustrator is..”, “the title is..”, “the story is called”, “turn the page” “open the book”, “there’s the front/back cover”, “the end”, “here are the words/sentence”, noting punctuation or how to hold book, etc.)	44–186	112 (42)

intonation/expression, or using gestures to help define vocabulary and/or concepts” (Parent Engagement and Interaction), which occurred on average 258 times per family across the three books (*SD*: 44.4). The least prevalent behavior was “*Parent pauses for 5 seconds to promote child response [to question]*” (Parent Engagement and Interaction), which was used by only 47% of families, on average 0.6 times per family across the three books (*SD*: 1.5). Overall, we observed relatively high engagement for the children, and children frequently responded to parent questions within 1 to 2 s (see Table 2).

Exploring Variation in Literacy Activities and SBR Behaviors

Demographic Analyses. To identify any potential demographic confounds for subsequent analysis, we examined relationships between parental reading practices and child or family demographic variables. Pearson correlations (Pearson, 1931) were utilized for continuous variables, (i.e., age at participation, age at diagnosis, age at cochlear implantation) and Kruskal–Wallis tests (Kruskal & Wallis, 1952) were used for the categorical variables (income, maternal education, gender, CI laterality, gender of the participating parent, presence of older siblings in the household, use of other communication modalities at home). As we did not adjust for multiple comparisons, these results are

exploratory, and any findings should be tested in a larger sample.

None of the demographic variables were associated with reading time (all *ps* > .05). On the questionnaire, parents’ reported frequency of SBR interactions (e.g., encouraging child questions, sitting with the child while reading) was associated with the use of other communication modalities: parents who used cued speech, total communication, or sign language (in addition to spoken English) reported using more interactive behaviors during book reading ($\chi^2 = 6.05$, $p = .014$). Additionally, certain *observed* parent behaviors were more commonly demonstrated in the videos with younger children, relative to older children. These included: Parent Interaction and Engagement ($r = -.53$, $p = .024$) and Literacy Teaching Techniques ($r = -.49$, $p = .038$). These exploratory analyses also revealed that some behaviors seem to vary by socioeconomic status. For instance, Child Engagement and Interaction differs in our sample by parent education, such that children of parents with less education showed slightly less engagement ($\chi^2 = 7.35$, $p = .025$). Similarly, parent behaviors varied by family income such that higher-income parents used literacy teaching techniques more frequently ($\chi^2 = 8.08$, $p = .044$).

Differences by Book. Kruskal–Wallis tests with follow-up Bonferroni-corrected Dunn tests (Dinno, 2015; Dunn, 1961) evaluated differences in parental reading behavior

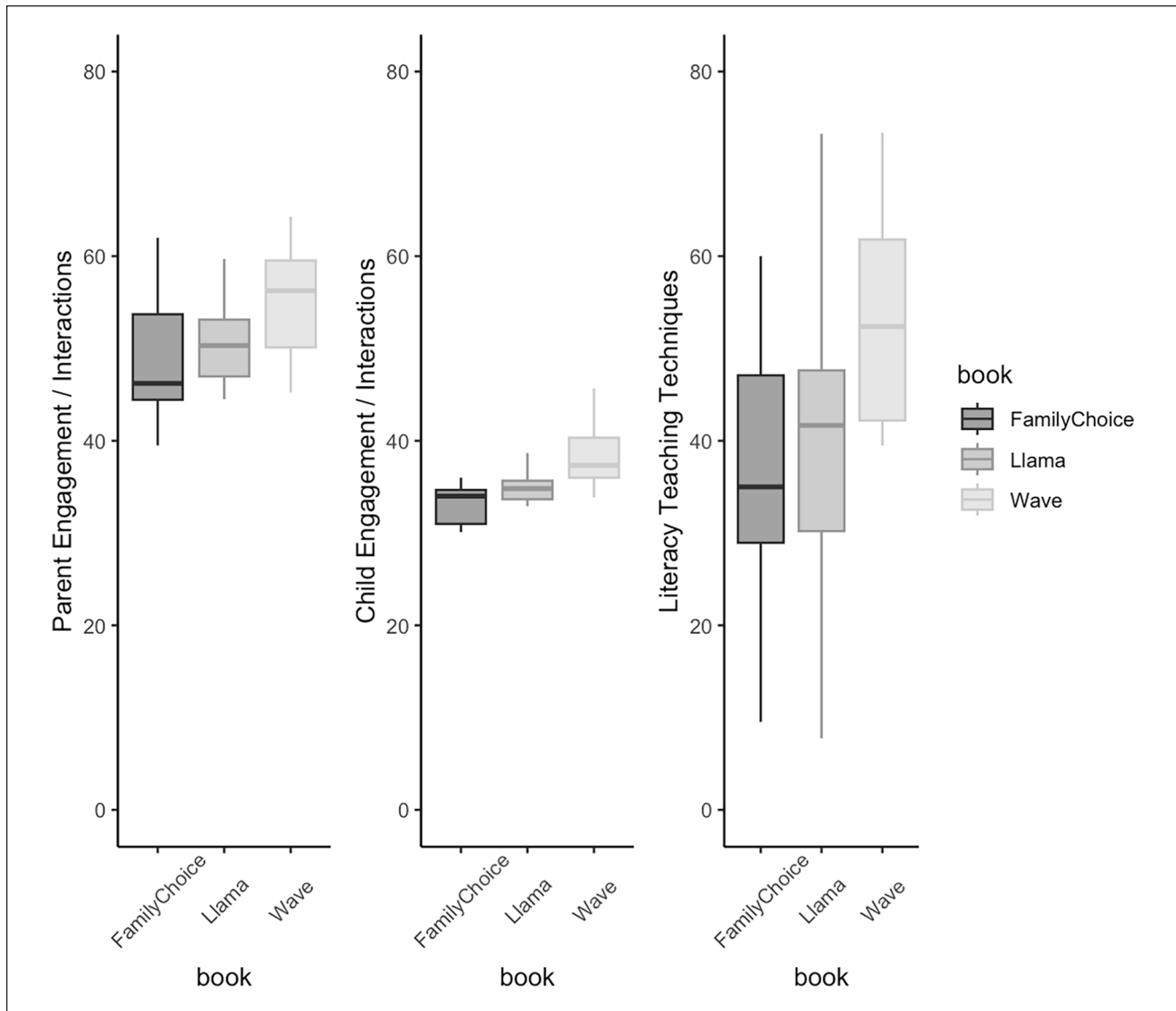


Figure 3. Frequency of Behaviors by Book.

Note. Frequency with which each behavior category was observed in video for each book.

across books (see Figure 3). Both Parent Engagement/Interaction behaviors ($\chi^2 = 9.09$, $p = .32$, 0.00 , and 0.01) and Literacy Teaching Techniques behaviors ($\chi^2 = 10.00$, $p = .25$, 0.00 , and 0.01) were observed more frequently for the wordless picture book than for the family choice book. Similarly, Child Engagement/Interactions behaviors were more frequent for the wordless book than *either* of the other books ($\chi^2 = 20.97$, $p = .047$, $< .001$, $.002$). To measure whether these behaviors were consistent within families across books, we ran intraclass correlations (Bartko, 1966) treating each book as a measurement of the behavior. We found significant correlations across books for Child Engagement/Interactions ($r = .49$, $p < .001$) and Literacy Teaching Techniques ($r = .32$, $p = .015$), showing that families' frequency of these behaviors is moderately consistent

across books. We did not find a significant intra-class correlation for Parent Engagement/Interactions ($r = .20$, $p = .079$), indicating that these behaviors may be more variable. Given that we are interested in the influence of SBR behaviors, which naturalistically would include multiple books, for subsequent analyses, we collapse across books and use a total score for each family for each behavior.

Predicting Literacy Outcomes

Associations Between Parent and Child Shared Book Reading Behaviors and Child Literacy. To address our third research question, we first measure zero-order associations between children's reading quotient and total parent-reported reading activities score, the three observed SBR behavior categories

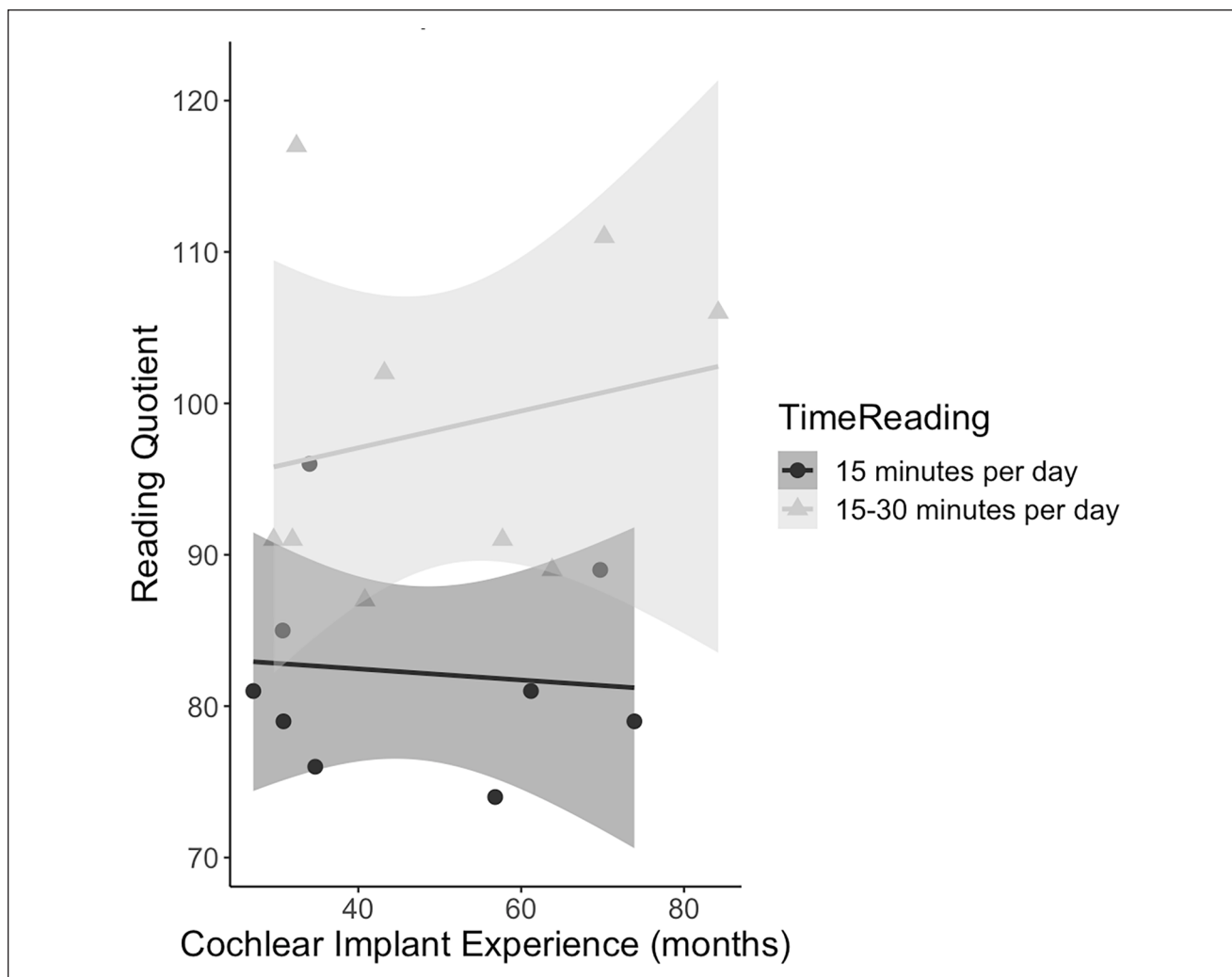


Figure 4. Interaction Between Reading Time and CI Experience Predicts Reading Quotient.

Note. Interaction between cochlear implant experience and reading time. Each dot represents one participant.

(Parent Engagement/Interaction, Child Engagement/Interaction, Literacy Teaching Techniques), by utilizing Bonferroni-corrected Kendall's Tau correlations (Schaeffer & Levitt, 1956). No significant correlations were found between any of the activities or SBR behaviors and child RQ, even before Bonferroni correction.

We further explored variability in reading outcomes by fitting a linear regression model (Su et al., 2012) to predict RQ, using our demographic variables, parent-reported reading activities, and observed reading behaviors. We pared down the model using stepwise model comparison, based on Akaike's Information Criterion (an estimate of the prediction error for the model; Cavanaugh & Neath, 2019; Ripley, 2022), which aims to account for the most amount of variance in reading quotient using the fewest predictor variables. The best-fitting model contained a significant main effect of oral language ability and a significant interaction between cochlear implant experience and

reading time. In this model, each one percentile increase in oral language score was associated with a 0.35 point increase in RQ ($p = .003$). For the interaction, results suggest a significant, positive effect of cochlear implant experience for the group of children who spent 15–30 minutes reading per day ($0.23, p = .032$), but *not* for the group who spent 0 to 15 minutes reading per day ($0.03, p = .791$); see Figure 4 for a visualization of this effect. This model accounts for 66% of the variability in reading ability ($p < .001$; Figure 5 for a summary of the regression results).

Discussion

Literacy skills vary considerably for young children with CIs (Mayer et al., 2021; Mayer & Trezek, 2018; Wang et al., 2021), but parents can play an important role in language and literacy outcomes for children with hearing loss (Aram et al., 2006; Ceh et al., 2013; DesJardin et al., 2009). This

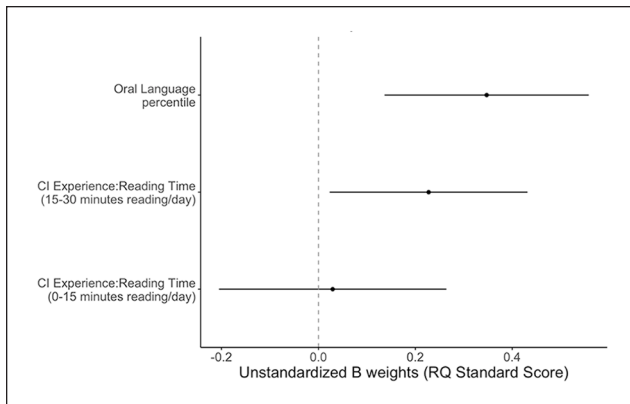


Figure 5. Summary of Model Results.

Note. Unstandardized beta weights from the model predicting Reading Quotient.

study investigated both parents' self-report of home literacy activities and observed parent and child SBR behaviors in young children with CIs. Specifically, our research questions explored the frequency of literacy-related activities and behaviors, whether parent literacy behaviors vary across different book types and demographic characteristics, and associations between parent/child demographic characteristics, parent/child literacy experiences, and children's early reading skills. Our results show that parents of children with CIs are actively engaged in shared book reading and other literacy activities with their children. This engagement is somewhat variable; parents demonstrate more SBR behaviors during a wordless picture book and possibly some variability related to age of the child and other demographic characteristics. Notably, our results suggest that the amount of daily reading time, CI experience, and oral language are strong predictors of literacy outcomes in children with CIs.

Prevalence of Home Literacy Activities and SBR Behaviors

We found that parents regularly engage in many literacy-promoting behaviors and activities at home. Varying intonation while reading was especially common. Commensurately, in the videos, we observed parents frequently elaborating on the text/images in the story and responding to the child's questions and comments. The questionnaire and reading sessions paint a picture of caregivers who are engaged and involved during SBR with their children. Highlighting parents' existing strengths while reading to their children might help promote this practice at home.

Exploring Variation in Literacy Activities and SBR Behaviors

Our exploratory analyses suggest several associations between demographic characteristics and the observed

SBR behaviors. Caregivers used Parent Interaction and Engagement and Literacy Teaching Techniques more often with younger children than with older children, paralleling age-related book reading styles in hearing children (Blake et al., 2006). Such age effects may be an effort from parents to provide additional SBR scaffolding to their young child with a CI. Additionally in our sample, we observe small differences in SBR behaviors by SES, which may be of interest for future work given that children from low SES households (Shera, 2014) and young children with hearing loss (Easterbrooks & Lederberg, 2021; Traxler, 2000) are already at increased risk for reading delays.

Regarding book type, we found children were more engaged and parents used more Literacy Teaching Techniques while reading the wordless picture book, compared with the books with words. These findings dovetail with literature on children with typical hearing, showing that teachers provide richer instructional feedback to children while reading wordless books than books with words (e.g., Chaparro-Moreno et al., 2017). These studies suggest that wordless picture books, through their lack of a prescribed script, encourage participants, namely parents and children, to engage more actively in the reading interaction.

Predicting Literacy Outcomes

Contrary to our predictions and previous literature (e.g., Ceh et al., 2013; DesJardin et al., 2011), we did not find significant correlations between any parent or child shared book reading behaviors and children's early reading skills. However, we are unconvinced that this reflects a true absence of effect. Given our small sample, we may have been underpowered to detect the effects of individual shared book-reading behaviors. It may be the case that it is not the frequency of reading behaviors measured during a short recording, but rather the accumulation of reading behaviors over developmental time, that yields a measurable difference. Our reading time measure could capture this accumulation. Parsing out this possibility would involve longitudinal work tracking the frequency of different reading behaviors and reading outcomes, potentially alongside parent interventions to increase frequency of individual behaviors. Alternatively, in studies of children with normal hearing, dialogic SBR behaviors, like the behaviors measured here in the videos, might be more effective with younger children (2–3 years) rather than older children (4–5 years) (Mol et al., 2008). Thus, these behaviors may have a smaller effect on our sample, of which two-thirds were 4-years-old or older. Future studies could parse out any age-related differences in effects using a cross-sectional design with multiple separate age groups.

Alternatively, the absence of any behavior-specific effects could simply suggest that the real magic of shared book reading may be simply that it increases the amount of time parent and child spend reading together. Noble et al.'s

(2019) meta-analytic work and large-sample randomized controlled trial (Noble et al., 2020) measured the effects of SBR parent interventions on parents of children with typical hearing. Both studies reported that while parent interventions *did* successfully increase the frequency of interactive book reading behaviors, the interventions seem to have no added benefit over an active control condition of just encouraging parents to read.

Likewise, in our analysis, despite a small sample size, our model results find a pronounced effect of overall reading time on the association between CI experience and literacy growth. *Only* when children receive more reading (>15 min per day), do we see that reading skill increases with CI experience. This effect suggests that children benefit from parents reading with them more, above and beyond implementing specific literacy-promoting behaviors. Similar to prior research (e.g., Spencer et al., 2003; Spencer & Oleson, 2008), we also find significant associations between oral language abilities and early literacy skills in this population, namely, that early literacy improves alongside improved language. Therefore, language-based interventions for this population may provide an additional benefit to children's literacy.

Implications for Researchers and Practitioners Working With Families of Children With Cochlear Implants

We found that parents regularly engage in various home reading practices that have been linked to language and literacy outcomes in children with (Aram et al., 2006; DesJardin et al., 2009) and without hearing loss (Anderson et al., 2019; Barnes & Puccioni, 2017; Clingenpeel & Pianta, 2007). Results from this study, however, suggest that reading time in particular is critical for early literacy skills in young children with CIs. Promoting parent self-efficacy, an individual's belief in their ability to successfully complete a task, maybe one avenue for clinicians and policy makers to empower parents to spend more time reading with their children. In families of young children with typical hearing, parental self-efficacy buffers against multiple barriers to shared book reading including parent fatigue, child fussiness, and environmental distractors (Lin et al., 2015). For children with hearing loss, parental self-efficacy is positively associated with children's language scores (Ambrose et al., 2020; DesJardin & Eisenberg, 2007) and may mitigate the negative effects of parental stress on language (Cejas et al., 2021). In our sample, parents already reported high self-efficacy related to promoting their child's language and literacy, but self-efficacy may vary across clinical contexts and demographic strata. To promote self-efficacy for shared book reading, early childhood professionals can counsel parents on the importance of shared book reading and highlight parents' strengths during SBR sessions.

Parents self-reported and were observed to regularly engage in various home literacy activities and SBR behaviors, which have been linked to language and literacy outcomes in children with (Aram et al., 2006; DesJardin et al., 2009) and without hearing loss (Anderson et al., 2019; Barnes & Puccioni, 2017; Clingenpeel & Pianta, 2007). In our sample, however, just reading *more* is linked with the largest bump in children's reading scores. In fact, the amount of reading time, coupled with cochlear implant experience, better predicted children's literacy abilities rather than CI experience alone.

To better understand the effects of SBR on literacy outcomes for children with cochlear implants, future research should aim to systematically test the effects of parent reading interventions in a large, demographically representative sample with multiple age bins. Following in the footsteps of Farquharson and Babeu (2020) and Noble et al. (2020), such a study could take a randomized control trial design and test the effects of SBR instruction (instructing parents in increasing the frequency of interactive behaviors during SBR, as by Farquharson & Babeu, 2020), relative to an active control condition (increase in reading time, no specific behavioral instruction) and a passive control condition (no increase in parent reading time or behavioral instruction). If, as our results and the Noble et al. (2020) results suggest, reading *time* is more influential than *how* parents read, we would expect both SBR instruction and the active control condition to improve reading outcomes over the control condition. If instead our current study is underpowered to detect the effect of parents' behaviors during SBR, then the RCT results should show higher reading improvement in the SBR instruction condition relative to both the active and passive control conditions. This proposed future direction would be time- and resource-intensive but could be feasible through collaboration between clinicians, researchers, and state-level educational programs for children with CIs. In our experience, families are enthusiastic to participate in research, and by increasing the rigor of studies investigating this population, we can make the most of families' time and efforts.

With early diagnosis, early access to services, and improvement in cochlear implant technology, parents who choose a CI for their children now have better opportunities to support their children's spoken language and literacy development (Carlyon & Goehring, 2021; Ching et al., 2013; Holzinger et al., 2011). The act of reading with children is associated with reading gains as children accrue hearing experiences with their CI. By empowering parents to read to children, clinicians can support literacy success in young children with cochlear implants.

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families and coded videos. E.C. coded videos, performed statistical analysis, and wrote the manuscript. H.F. and J.D. commented on and edited the manuscript at all stages.

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ORCID iD

Erin E. Campbell  <https://orcid.org/0000-0002-8770-2317>

Supplemental Material

Supplementary material for this article is available on the Communication Disorders Quarterly website at <https://cdq.sagepub.com>.

Notes

1. A new version of the TERA was released in 2018, after data collection for this study concluded. For the most recent TERA, see Reid et al. (2018).
2. All of the parent choice books contained words.

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