ABSTRACT: Purpose: The purpose of this systematic review was to determine what intervention programs may best help children with cochlear implants (CIs) to acquire critical emergent literacy skills, specifically, phonological awareness and oral language skills. This review offers a better understanding of directions for future research as well as how clinicians can provide children who are deaf or hard of hearing with the tools needed to be successful in reading and writing, thereby providing a solid foundation for future academic success.

Method: A systematic review of the current literature was used to identify possible interventions for helping children with CIs attain the emergent literacy skills of phonological awareness and oral language. Few intervention programs designed for this specific population were found. Therefore, intervention programs designed for children with hearing loss in general were appraised and were applied to preschool-age children with CIs. Five articles were identified and used in the review.

Results: Results revealed a limited number of intervention studies that included children with CIs. Within the studies that met the inclusion criteria, there was support for visual phonics as an effective phonological awareness treatment. Studies included in the review also suggested that caregiver training programs increase the quality of language input provided to children with CIs.

Conclusions: Future research should replicate and extend the studies included in the review using larger sample sizes across diverse contexts. These studies could also allow for more detailed comparisons between children with CIs and their normal-hearing peers.

KEY WORDS: cochlear implants, emergent literacy, preschool children
It may take more time and instruction for a child who is deaf or hard of hearing (hereafter referred to as DHH children) to acquire phonological awareness, a difficult skill for many children to acquire. Phonological awareness (PA) is defined as the ability to detect spoken language units of sound (also known as phonemes) that help determine a word’s meaning. It is well documented that children who are deaf or hard of hearing (DHH) are at risk for literacy delays compared to their peers without HL. The American Speech-Language-Hearing Association (ASHA) reported that children with a severe-to-profound HL who do not receive proper intervention are at risk of only reaching third- to fourth-grade academic achievement levels, especially in the areas of reading and mathematics (“Effects of Hearing Loss on Development,” n.d.). Therefore, strengthening the early literacy skills of preschool DHH children is a means toward increasing literacy achievement in this population.

**Emergent Literacy**

One of the most important elements of emergent literacy is phonological awareness. Research indicates that phonological awareness is a strong predictor of later reading success (Anthony & Francis, 2005). The National Early Literacy Panel describes phonological awareness as the ability to detect spoken language and manipulate or analyze the information into words, syllables, or phonemes (National Institute for Literacy, 2008). A child must know, hear, and be able to understand that words are made up of even smaller units of sound (also known as phonemes) that help determine a word’s meaning. Phonological awareness has a complementary relationship with print (alphabet) knowledge (Molfese et al., 2006). This relationship between phonological awareness and print knowledge supports a child’s development toward advanced literacy skills. The concept of phonological awareness is critical to later reading success, but it is also a difficult skill for many children to acquire. It may take more time and instruction for a child to gain the skills necessary in phonological awareness versus other emergent literacy skills (Schuele & Boudreau, 2008).

Oral language includes a child’s ability to understand, and also to produce, spoken language. Like phonological awareness, oral language plays a substantial role in later literacy growth and achievement (National Institute for Literacy, 2008). In a longitudinal study, Hart and Risley (1995) found that children entering their preschool and kindergarten years with lower vocabulary tended not only to maintain a low vocabulary throughout their school years compared to their peers, but also to take more time to acquire new words. This performance gap existed at the early childhood level and continued to widen throughout adulthood.

As a primary source of spoken language input, caregivers play an important role in their child’s vocabulary and emergent literacy skill development. However, there is variability in the amount and quality of adult language input, and Ambrose, VanDam, and Moeller (2014) suggested that children with HL are more likely to receive a lower quality of language input than children without HL. Researchers attribute these conversational differences to the idea that parents talk at the language level they perceive their child to be, rather than at what would be considered a developmentally appropriate language level (Ambrose et al., 2014).

DHH children are often already at a disadvantage when developing spoken language and literacy due to limited and/or a lack of consistent access to the auditory and linguistic input necessary for language development (Ambrose et al., 2014). Communication exchanges at a lower language level can further disadvantage these children’s development of spoken language and literacy, as DHH children often need greater exposure and more linguistic examples than children without HL (DesJardin, Ambrose, & Eisenberg, 2009) in order to ultimately comprehend information.

The research regarding phonological awareness and oral language skills shows the importance of, and challenges associated with, building emergent literacy skills in young DHH children. Both skills are introduced during the early preschool and kindergarten years and continue to develop together throughout a child’s journey to literacy. Together, these two emergent literacy skills—phonological awareness and oral language—make up two of the most critical skills that preschool and kindergarten children need to master in order to become successful readers (National Institute for Literacy, 2008). Skill in these areas positions children for success in literacy, which will also undoubtedly help them throughout their academic career.

A DHH child will require even more attention and strategic planning than a child without HL.
to learn emergent literacy skills. A child with a CI who has limited access to an acoustic signal is at a disadvantage compared to his or her peers with normal hearing (Lee, Yim, & Sim, 2012; Nittrouer et al., 2012). Even though a CI can provide a listener with access to sound, it does not provide them with normal hearing. According to its website, the FDA (2010) indicates that children who receive a CI may initially experience improvement at a slower rate after activation and programming of the device compared to adults because children are building new auditory and language skills rather than attaching a new input to an existing structure. Children may therefore need time to learn to use the new experience of hearing and to train their brains to adapt and use the sounds they are experiencing (FDA, 2010). The issue of slower improvement and adaptation for children with a CI may be attributed to the fact that many of the children who are implanted with the device have had little, if any, exposure to sound during their lifetime due to the early onset and severity of their HL.

Despite a possible lack of auditory exposure very early in life, many children with an HL can benefit from a CI and develop speech and language skills (Discolo & Hirose, 2002) given early identification of the HL and early implantation of the CI (Golley, Sharma, & Dorman, 2008). The timeline in which these children develop speech and language skills, however, varies in comparison to their peers without HL (Chute & Nevins, 2003). Considerations should be made to determine what puts children with a CI at a greater risk when it comes to learning emergent literacy skills and how professionals can teach children with a CI the skills they need for future academic success.

Even though children who use a CI can perceive sound, they may not have access to all of the acoustic information available in the original speech signal. Multiple studies have demonstrated the limitations of CIs in representing a natural speech signal (e.g., Ambrose, Fey, & Eisenberg, 2012; Lee et al., 2012; Nittrouer et al., 2012). A CI simply cannot convey all of the acoustic cues involved in speech and music perception, which therefore limits the accuracy with which the sound and phonological representations are delivered to the CI user. Limited access to the full auditory signal puts children with a CI at a disadvantage in comparison to their normal-hearing peers in terms of acquiring phonological awareness skills (Nittrouer et al., 2012).

Nittrouer et al. (2012) sought to examine the differences in acquiring literacy skills between DHH children who use a CI and children without HL. They did this by comparing the children’s outcomes on measures of phonological awareness, oral language, executive functioning, and emergent literacy skills. Results suggested that reading ability was dependent on the children’s access to acoustic information and their ability to develop adequate sensitivity to phonemic structure. Participants with a CI had restricted access to the acoustic signal and therefore did not score as well as their peers when phonological awareness skills were assessed. These children did score similarly to their normal-hearing peers on basic phonological awareness skills, but did not score comparatively to their peers on harder phonological awareness tasks. These more difficult tasks require greater sensitivity to phonemic structures and better short-term memory (Nittrouer et al., 2012). Results from Nittrouer et al. demonstrate the importance of phonological awareness for literacy development and document the delays that children with a CI may exhibit in more complex phonological awareness tasks.

**Oral Language**

In addition to an impact on a child’s phonological awareness, cochlear implantation may also heavily affect a child’s oral language ability (Geers, Moog, Biedenstein, Brenner, & Hayes, 2009). One rationale for implanting children with a CI at an early age is to give them as much exposure as possible to auditory stimuli, which would allow them to work toward age-appropriate levels of spoken language in a developmental process (Geers et al., 2009). However, children may still lag behind their normal-hearing peers in oral language skills (Spencer, Barker, & Tomblin, 2003). According to Nittrouer et al. (2012), children with a CI still fall behind their normal-age peers in auditory comprehension, expressive vocabulary, and narrative skill (p. 695).

A strong body of research suggests that early intervention contributes to improved outcomes for children with a CI. For example, multiple studies have stressed the importance of early intervention and implantation (e.g., Discolo & Hirose, 2002; Geers et al., 2009; Ganek, Robbins, & Niparko, 2012; Lee et al., 2012; Spencer et al., 2003). The earlier a child receives a CI, the better he or she is equipped to acquire emergent literacy skills (Geers et al., 2009; Waltzman & Roland, 2006). Children implanted before 42 months of age were found to have literacy skills that were more comparable to those of their peers without HL compared to children who were implanted at a later age (Archbold et al., 2008). However, children with a CI may continue to lag behind their normal-hearing peers in attaining these skills (Spencer et al., 2003). Despite the possible risk of children with a CI falling behind in their oral language skills, these children may still have the opportunity to meet classroom expectations later on.
when learning to read and write when given proper intervention (Spencer et al., 2003).

**Emergent Literacy and CIs: Where Do We Go From Here?**

A strong base of observational research provides insight into environmental factors that contribute to improved outcomes for children with a CI (e.g., Ching, Day, & Cupples, 2013). Early identification of HL, use of a CI, and submersion in a language-rich environment have been shown to promote early literacy skills in DHH children and those who use a CI (e.g., Lederberg, Shick, & Spencer, 2012). However, despite what we know about emergent literacy and CIs independently, these topics have not yet been fully explored in regard to establishing successful treatment interventions that support the development of critical emergent literacy skills, such as phonological awareness and oral language, for pediatric CI users. At this time, clinicians must rely on current emergent literacy interventions designed for DHH, normal hearing, or other populations, and modify them to ensure their appropriateness for children with a CI.

A review of interventions that have been conducted with children with a CI is necessary in order to establish effective intervention procedures. Therefore, the purpose of this project was to complete a systematic review of the literature in order to evaluate phonological awareness and oral language interventions designed for preschool DHH children with a CI. A systematic review was chosen because it allows for rigorous review and appraisal of evidence that meets strict inclusion criteria (Wright, Brand, Dunn, & Spindler, 2007). Through careful review of the current literature regarding CIs and emergent literacy, a systematic review can summarize the current state of the literature, provide evidence-based guidelines for practice, and suggest areas of future research. In this systematic review, we posed the following question: Is there evidence to support the use of emergent literacy interventions with preschool children with a CI in terms of improved phonological awareness or oral/expressive language?

**METHOD**

**Search Strategy**

Evidence for the systematic review was identified through electronic database searches of ASHA, EBSCOhost, PsycINFO, and ScienceDirect, as well as through hand searches of reference lists within potential articles. Key search terms were *phonological awareness, oral language, preschool, hearing loss*, and *cochlear implant*. Table 1 shows the number of articles used from each database.

**Selection Procedure**

**Inclusion criteria.** Upon completion of a preliminary examination of all abstracts and further analysis using inclusion and exclusion criteria, we found five articles that met our screening criteria. Tables 2 and 3 outline the articles included in our review. Articles considered relevant to the review question needed to be empirical in nature and published after 1993 (i.e., within the last 22 years). Other inclusion criteria included (a) participants were children of preschool or kindergarten age (between 3 and 6 years), (b) one of the emergent literacy skills (i.e., phonological awareness, and/or oral language) was investigated, and (c) DHH children and/or children with a CI were included.

We included studies targeting DHH children because children with a CI are a subset of the larger population of DHH children, and there are meaningful similarities between these groups of children. Of primary importance, both of these groups of children (DHH and CI) will have limited access to their auditory environment. For example, both groups will likely experience inferior consonant perception compared to vowel perception (Tye-Murray, 2004), difficulty with consonant place cues, and difficulty listening in background noise (Moeller et al., 2007a). Further, both groups will follow the developmental hierarchy for auditory and language learning and will demonstrate large variability in performance across individuals within each group (Sanders, 2013).

Despite these similarities, there are differences between the two groups that should be considered when applying conclusions drawn from studies involving DHH children to children with a CI. Specifically, because children with a CI are only a subset of the population of DHH children, the variability in performance, acoustic access to the environment, and other concomitant factors will be much greater for the DHH group than for the group with CIs. In general, children who use a CI have greater access to high-frequency sounds (Stelmachowicz, Pittman, Hoover, Lewis, & Moeller, 2004), better detection skills, and greater potential for incidental learning (Marschark, Rhoten, & Fabich, 2007) than children with severe HL that use hearing aids. As such, expansion of the inclusion criteria to DHH children should allow for a larger body of applicable research. (However, conclusions based on studies that included only DHH children that did not use a CI were made with caution.)

**Exclusion criteria.** We excluded studies from the systematic review based on the following criteria:
(a) studies that used an observational research design versus an experimental or intervention-based design, (b) studies that excluded DHH children, (c) studies that did not include at least one of the desired emergent literacy skills (i.e., phonological awareness and/or oral language), (d) studies that did not include children within the targeted age range (3 to 6 years), and (e) studies that were not published within the last 22 years (before 1993).

### Rating of Quality Evidence

To evaluate the research evidence, we used the Schlosser and Raghavendra (2004) evidence appraisal hierarchy for participants with disabilities. This rating scheme evaluates evidence on several levels, including internal validity, external validity, and social validity. Research designs are ranked between 1 and 5, with 1 being the design with the fewest threats to internal validity, thus, a stronger research design. Schlosser and Raghavendra recommended that external and social validity also be included in an appraisal so as to discuss the research design’s applicability for generalization outside of the study and translation to everyday practice. Two authors (first and third) independently ranked each of the five articles based on Schlosser and Raghavendra’s hierarchy. Interrater agreement was 100%; both authors classified the five
articles as level 4, which consist of preexperimental designs such as single-case studies and one-group pretest–posttest designs.

**RESULTS**

A total of five articles were identified and are included in this review. Only these five articles met both the inclusion and exclusion criteria. All articles were published between 2001 and 2013, and all were appraised at level 4 on the Schlosser and Raghavendra (2004) rating scale for participants with disabilities.

**Phonological Awareness**

The initial search terms yielded two articles specific to children with a CI (Miller, Lederberg, & Easterbrooks, 2013; Smith & Wang, 2010) and one article that included children with a CI and children with hearing aids (Aram, Most, & Mayafit, 2006). These articles are summarized in Table 2.

Smith and Wang (2010) completed a case study that investigated the impact of visual phonics combined with a modified Fountas and Pinnell (2002) kindergarten phonics curriculum on the phonological awareness skills of a 4-year-old male with a CI. The visual phonics instruction included in the study
consisted of hand gestures, tactile cues, and kinesesthetic representations to help aid in the production of speech sounds. The rationale for this type of instruction is that children with limited access to the acoustic structure of sounds can learn to associate a gesture or movement with a particular sound, and may therefore be able to differentiate among sounds using these gestures. Additionally, the Fountas and Pinnell kindergarten phonics curriculum is designed to encourage kindergarten children to engage in print knowledge and phonological awareness activities throughout various school activities. In the study, the participant was enrolled in 15- to 20-min sessions of treatment 4 days per week for a total of 6 weeks.

Comparing pre- to posttest results, Smith and Wang (2010) indicated that the participant made significant progress in phonological awareness and the production of speech sounds after completing the intervention program. The participant was able to identify target vowel phonemes with 100% accuracy and was able to achieve mastery (≥90%) in other areas such as identifying first letters, identifying sounds in words, and identifying beginning consonant sounds. Following the program, the participant also demonstrated an understanding that words are composed of individual sounds, and he was better able to model all of the sounds. These results suggest that a visual phonics program coupled with a modified phonics program such as the Fountas and Pinnell (2002) kindergarten phonics curriculum, may help increase phonological awareness skills in children with a CI. Replication of Smith and Wang’s study with a larger sample of DHH students would strengthen and validate these findings.

Miller et al. (2013) built on the previous study by investigating the development of spoken phonological awareness skills for DHH children with functional hearing after amplification. The study used a single-subject multiple-baseline preexperimental design, which included five preschool-age children. Three of these children used a CI; the other two children included in the study used a hearing aid. Over the course of 1 school year, each of the children participated in a foundations for literacy (Lederberg, Miller, Easterbrooks, & Connor, 2011) intervention program that was designed to increase their phonological awareness skills in the three areas of syllable segmentation, initial phoneme isolation, and rhyme

<table>
<thead>
<tr>
<th>Citation</th>
<th>Research question</th>
<th>Research design</th>
<th>Include children with CIs/hearing loss?</th>
<th>Major findings</th>
<th>Limitations</th>
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<tr>
<td>Harrigan, S., &amp; Nikopoloupolos, T. P. (2002). Parent interaction course in order to enhance communication skills between parents and children following pediatric cochlear implantation. <em>International Journal of Pediatric Otorhinolaryngology</em>, 66, 161–166.</td>
<td>Does a modified Hanen “It Takes Two to Talk” training course improve the communication skills of parents with children with cochlear implants?</td>
<td>Experimental</td>
<td>Yes</td>
<td>Upon completion of the training course, parents were successful in decreasing their number of initiations and increasing their number of responses, therefore allowing their child to initiate and direct more of their conversations.</td>
<td>Did not investigate the impact the intervention had on the children in the study or how the program was modified.</td>
</tr>
<tr>
<td>Paganga, S., Tucker, E., Harrigan, S., &amp; Lutman, M. (2001). Evaluating training courses for parents of children with cochlear implants. <em>International Journal of Language and Communication Disorders</em>, 36, 517–522.</td>
<td>Does a modified Hanen “Making Hanen Happen” training course improve communication skills between parents and their children with cochlear implants?</td>
<td>Experimental</td>
<td>Yes</td>
<td>Upon completion of the training course, parents were considered more successful in communicating with their child compared to pre-intervention.</td>
<td>No information provided regarding how the program was modified; no identifying information provided regarding children’s ages, length of CI use, and other key factors; duration of training program not provided,</td>
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The foundations for literacy (Lederberg et al., 2011) intervention program was designed to focus on increasing foundational skills that are critical to word identification and language comprehension for hearing children, and was further supplemented in this study with cued speech and visual phonics. Intervention was delivered to each participant for 1-hr sessions, twice per week, which yielded 104 total intervention sessions throughout the school year. Pre- and postintervention test measures from Miller et al. concluded that by the end of the intervention, four of the five children were able to segment words consistently, three of the five were able to complete rhyme discrimination tasks, and all five were able to isolate initial phonemes. Miller et al. also reported that for initial phoneme isolation, four of the five children were found to have completed the task independent of their alphabet knowledge.

The results of Miller et al. (2013) suggest that explicit phonological awareness instruction is an effective method for increasing phonological awareness skills to more age-appropriate levels for DHH children. The researchers also noted that one of the children included in the study initially exhibited lower speech perception skills than all of the other participants, and consistently scored lower on all skills throughout the course of the study. This participant was also the only child who was unilaterally amplified. The other four participants received bilateral amplification. Based on this observation, Miller et al. suggested that the modified foundations for literacy (Lederberg et al., 2011) intervention program might rely on receptive spoken language skills. They also suggested that these findings show a relationship between phonological awareness and oral language development in general. It may be that some base oral language skills are necessary in order to benefit from this intervention program.

Although Miller et al. (2013) provided important insight into effective interventions targeting phonological awareness skills, there are some limitations worth considering. As with single-subject designs, there was a small sample size; therefore, findings from this study may not be statistically generalized to all DHH children. Also, the strategies implemented in the program may or may not be effective outside the realms of the foundations for literacy (Lederberg et al., 2011) program. The first author of the paper was also a primary developer of the foundations for literacy (Lederberg et al., 2011) program and served as a supervisor for the researchers, which could introduce some bias. Children’s assessments also were not necessarily reliable due to a lack of intrajudge reliability measures.

Aram et al. (2006) investigated the impact of mother–child storytelling and joint writing activities on literacy development in kindergarten DHH children. Thirty kindergarten DHH children between the ages of 5:0 (years;months) and 7:0 participated in the study. All of the children used amplification devices: 19 used a hearing aid and 11 used a CI. The mothers were video recorded while telling a story to their child using a wordless picture book that was unfamiliar to both the child and the mother. The mothers were also videotaped and were evaluated in terms of their ability to guide their child through a writing activity. The children were independently tested in regard to their early literacy skills, including phonological awareness. The interactions between mother and child, as well as the child’s independent scores, were then compared.

Results showed that storybook telling facilitated procedures, such as interactive reading, dialogic reading, and wh-questions, correlated significantly with the child’s linguistic skills, including phonological awareness. Storybook telling explained the added variance of phonological awareness and other skills as well. Overall, the more interactive a mother was with her child during shared storybook reading, the higher the child’s emergent literacy skills, including phonological awareness. Some limitations of the study included lack of a control group and wide variance in the duration of the mother–child interaction; for example, durations ranged from 4 min 48 s up to 29 min 42 s.

These three articles—Smith and Wang (2010), Miller et al. (2013), and Aram et al. (2006)—provide suggestive evidence of interventions that may improve phonological awareness skills in preschool children with a CI. Smith and Wang (2010) and Miller et al. (2013) are two of the first studies of their kind to use children with a CI to test the benefit of a specific intervention. Findings from the three studies suggest that children with a CI may benefit from explicit phonological instruction using one or more of the approaches explained or described in (a) a visual phonics program, (b) the Fountas and Pinnell kindergarten phonics curriculum (Fountas & Pinnell, 2002), and (c) a modified version of the foundations for literacy (Lederberg et al., 2011) program. It does seem, however, that these children may require some foundational oral language skills in order to experience maximum benefit from the foundations for literacy (Lederberg et al., 2011) intervention. Aram et al. (2006) also provided insight into the impact that caregivers and literacy activities may have on children’s phonological awareness skills. Shared book reading and other activities that promote early literacy may also have a positive impact on children’s phonological awareness. It seems that the more opportunities a child has to access print, the greater the chances of increasing his or her emergent literacy skills.
The overall quality and validity of the articles discussing phonological awareness varied considerably. Smith and Wang (2010), Miller et al. (2013), and Aram et al. (2006) each addressed different aspects of phonological awareness, which together provide a better overall understanding of phonological awareness interventions and possible directions for future research. Smith and Wang (2010) and Miller et al. (2013) set the groundwork for future studies in showing the benefit of explicit phonological awareness skill instruction through their single-subject designs. Aram et al. may also contribute to the overall understanding of phonological awareness and future directions for research, but threats to internal validity, such as maturation, lack of blinding, and limitations in generalizing findings to other populations (i.e., children with a CI), keep it from being included as a key study. Future research should explore these interventions in reference to children with a CI in order to test their success in this specific population.

**Oral Language**

The search for literature concerning oral language instruction for children with a CI yielded two articles: Harrigan and Nikolopoulos (2002) and Paganga, Tucker, Harrigan, and Lutman (2001). Table 3 provides a summary of each of the articles as they relate to the research question.

The purpose of Harrigan and Nikolopoulos (2002) was to investigate how communication skills between parents and their children with a CI change after attending parental interaction training courses. In this study, researchers used a modified version of Hanen’s “It Takes Two to Talk” (Manolson, 1992) program. This specific Hanen intervention program focuses on teaching parents conversational skills so as to promote their child’s oral language and vocalization skills by asking more questions and allowing the child to lead the conversation. The Hanen approach encourages parents to observe, wait, and listen to their child’s attempt at communication before responding to the child. Hanen programs were initially used for children with low oral language abilities; not until recently have they been used by parents with children using a CI.

Seventeen parents of 11 children with a CI participated in the Harrigan and Nikolopoulos (2002) study. The children were between the ages of 2 and 6 years. The parents participated in a 3-day training course of the modified “It Takes Two to Talk” (Manolson, 1992) program, along with home visits to help them develop better communication skills. Video samples of a parent–child conversation were taken in the home 1 month before the start of the training course, and then again 1 month after completion of the training course. Sixteen out of the 17 parents were also videotaped again 12 months later to investigate their maintenance abilities after completing the program. Results showed that the parents had successfully decreased the number of conversational initiations and responses by 50% during conversation with their child after completion of the program. Maintenance results from 1 year later indicated that the number of parental initiations and responses had increased but were not as high as the number of responses taken before the start of the intervention program.

The results of Harrigan and Nikolopoulos (2002) showed that parents of children with a CI can learn to communicate more effectively with their children and allow for the children to control more of the conversation, thus potentially increasing their number of vocalizations. However, despite the reported progress, there were limitations. The main limitation of the study as it relates to this review is that it only investigated the number of initiations and responses in parents and did not focus on the children’s language development. For this reason, it is difficult to conclusively state that this intervention promotes oral language development in children with a CI. However, because similar changes in caregiver–child interactions have been linked to increased child vocabulary and syntactic complexity in children with expressive vocabulary delays (Girola, Metto, Pearce, & Weitzman, 1996), it is reasonable to hypothesize that these methods would be beneficial for children with a CI. Therefore, we included Harrigan and Nikolopoulos in this systematic review, but conclusive judgments about the efficacy of this intervention should be reserved until future studies include child language measurements.

In a similar study, Paganga et al. (2001) evaluated the change in effective communication between parents and their children with a CI after the parents attended a modified Hanen “Making Hanen Happen” (Watson, 1995) training program. Eighteen parents were trained using the modified program to fit the special needs of children with a CI. To monitor the effects of the program, the parents completed 36 videotaped sessions with their children over the course of the program. One-minute excerpts were taken from each video and were placed in random order (from either pre- to postintervention or post- to preintervention) to create one video. Videos were then rated on a 1 to 5 scale for effective parent–child communication by seven naive judges with no prior experience with the Hanen program or with DDHH children. Results of the seven raters concluded that the parents were more effective at communicating with their child after the intervention compared to before the intervention. These results also agreed with the findings...
from the speech-language pathologists who administered the training program to the parents.

Results of Paganga et al. (2001) indicated that after completion of a modified “Making Hanen Happen” (Watson, 1995) training program, the parents of children with a CI were more effective at communicating with their child. Similar to Harrigan and Nikolopoulos (2002) described previously, Paganga et al. is limited in its contribution to this review’s overall purpose due to its lack of focus on the children’s language development as a result of the program. However, the information it does provide may be helpful in designing future studies that observe how these training programs affect the oral language skills of the child.

Paganga et al. (2001) is also limited in its overall validity and reliability because no information was provided related to treatment integrity, such as how the Hanen program was modified. The authors only stated that more emphasis was placed on sections of the training program that focused on areas that were considered more relevant to DHH children. The duration of typical Hanen sessions was also modified, and no detail regarding the duration of the training program was provided. Also, the parents were dispersed between two different CI centers where they participated in the training course, and there was no indication of methods to ensure treatment fidelity across the two sites. Plus, there is no operational definition of “effective communication.” Rather, Paganga et al. reported that the parents were seen to be more effective in their communication, but they did not explain what that meant. Finally, no information was provided regarding the children who participated in the study. The number of children, age of children, duration of CI use, and other key identifying information was not provided, which greatly limits the readers’ interpretation of the results.

The articles discussing interventions and their impact on increasing oral language skills included in this section are a preview of interventions for children with a CI in the future. Harrigan and Nikolopoulos (2002) and Paganga et al. (2001) evaluated the effectiveness of modified Hanen programs in providing more effective communication strategies for parents of children with a CI. The Hanen intervention programs were initially designed to benefit children who exhibit low oral language abilities. Harrigan and Nikolopoulos and Paganga et al. provide insight as to how parents can facilitate conversations between themselves and their children with a CI, but neither of these interventions specifically measured communication changes in the child. Even though parents provide an environment that supports their children’s oral language development, it may not be enough support to directly improve the children’s language skills. Future research with Hanen programs should investigate how these changes in interaction and conversational style by parents can impact the child’s number and quality of initiations and responses.

The overall quality of the articles targeting oral language was less than desirable. Both Harrigan and Nikolopoulos (2002) and Paganga et al. (2001) lacked some key research design elements, such as investigator blinding and adequate demographic information. Neither of the articles fully addressed the criterion sought in this review, but their promise for future directions and the inclusion of children with a CI made them appropriate for inclusion. Paganga et al. failed to include key identifying information, which reduces its usefulness. Conclusions regarding these language interventions may apply to children with a CI, but more research is needed to help validate these claims.

**DISCUSSION**

The aim of this review was to identify articles that discussed interventions that successfully increased emergent literacy skills, specifically phonological awareness and oral language skills, in preschool-age children with a CI. We anticipated that little research would be found for this specific population. Search terms were therefore broadened to include DHH children in general. Five articles were retrieved from the search, and of these articles, two fit the exact criterion. Smith and Wang (2010) and Miller et al. (2013) both investigated the effectiveness of a specific intervention to increase phonological awareness skills in DHH children. These two articles have set the groundwork for more research on the effectiveness of increasing phonological awareness in preschool children with a CI. Future research in this area should expand on explicit phonological awareness instruction methods in this specific population. Larger sample sizes and investigating the long-term applicability of these interventions is needed in future studies. Researchers should also consider investigating optimal treatment schedules for increasing phonological awareness, as well as how access to print affects the development of phonological awareness in DHH children.

The studies in this systematic review that included DHH children in general should be replicated with the inclusion of children who use a CI. Both populations have a lack of access to their acoustic environments, but the acoustic information provided by a CI is unique, and the performance of DHH participants that is not mitigated by a CI should not be generalized to children with a CI.
No information was found in regard to interventions that are aimed specifically at increasing oral language skills in the targeted population of preschool children with a CI. Instead, the evidence targeted a different, but related, population; that is, parents of children with a CI (Harrigan & Nikolopoulos, 2002; Paganga et al., 2001). The studies suggest that explicit parental instruction from a modified Hanen training program may be effective in promoting more conversational interactions between parents and their children with a CI, potentially increasing the children’s oral language skills. More research is needed, however, to truly validate the claims that these programs do, in fact, benefit language development for children with a CI.

Future Directions

Observational research regarding pediatric users of a CI has improved our understanding of the differences that exist between this unique population and their peers without HL. Early identification of HL and subsequent implantation of a CI will lead to greater success for DHH children and help them perform more similarly to their peers without HL (Waltzman & Cohen 1998). More experimental research in the area of intervention strategies is necessary to help DHH children become successful in developing emergent literacy skills and sustaining language and literacy development throughout their academic careers. However, these children will require accommodations and interventions that support the development of these skills (Chute & Nevins, 2003).

The aim of this article was to evaluate the state of the evidence base for early literacy interventions for children with a CI and to generate directions for future research. Obviously, there are numerous directions for future research in this area. This review certainly revealed a need for studies with larger sample sizes across more diverse contexts. Another logical next step would be to replicate methods that were previously found to be effective with children that do not exhibit HL. For example, further investigation of oral language and literacy curricula similar to Justice and Ezell (2000) and Fricke, Bowyer-Crane, Haley, Hulme, and Snowling (2012) would strengthen the body of evidence for interventions in an inclusive, natural environment.

In addition, future research needs to move beyond the replication of current methods to develop methods that consider the unique learning profiles of children with a CI. This may include consideration of factors such as the positioning of children during intervention and the utilization of instructional strategies that support acoustic access during intervention. To allow for between-group comparisons, studies should include children with and without HL. Finally, employing longitudinal designs that investigate the long-term outcomes of early literacy interventions would be highly desirable in establishing evidence-based methods to promote the early literacy development of children with a CI.

REFERENCES


Contact author: Kyle Brouwer, 414 East Clark Street, Vermillion, SD 57069. E-mail: kyle.brouwer@usd.edu