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Complex Syntax Acquisition in Children with Hearing Loss

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ABSTRACT

Purpose: The purpose of this language sample analysis was to describe complex syntax development in children with hearing loss over the preschool years. The current study addresses the following relevant research questions: Do children with hearing loss have increased performance over preschool years on broad measures of complex syntax? and What are the developmental trajectories on complex syntax in children with hearing loss?

Methods: 9 children with hearing loss participated in a 12-minute language sample following the Hadley Protocol (1998). Each child was tested at age 4 and then again in 6-month intervals until they turned 6. These children with hearing loss reported using spoken language as their primary form of communication and use amplification. Additionally, the participants use cochlear implants, hearing aids, or both. Participants in this group have no other external diagnoses.

Results: During the preschool years, complex syntax density increased in children with hearing loss. The participants also produced a relatively low rate of errors in complex syntax productions. Children with hearing loss exhibited the most significant growth for coordinate clauses, reduced infinitives, simple infinitives, full propositional clauses, and headless relative clauses.

Conclusions: The results of this study suggest that children with hearing loss are producing utterances containing complex syntax with limited errors and their complex syntax density is increasing over time.

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CHAPTER 1

INTRODUCTION

Children with hearing loss are at a disadvantage for overall language development compared to their peers with normal hearing. Current research reveals that acquisition of language skills is typically delayed and different in children with hearing loss as compared to children with typical hearing (Koehlinger, Van Horne, & Moeller, 2013; Werfel, 2018). These language skills are crucial for a child's overall development and academic success. Children with bilateral sensorineural hearing loss typically fall below their hearing peers in measures of language and literacy and acquire essential linguistic skills later in development. These delays can negatively impact their academic success. Early detection of these delays and intense intervention can support academic success and lead to better vocational outcomes for children with hearing loss.

Language Overview

Language is a broad term that encompasses several different elements: semantics, phonology, morphology, pragmatics, and syntax. Semantics is the area of language involving meaning; this meaning occurs at the word, phrase, or text level. Children who struggle with semantics often display difficulties in using words appropriately within their spoken and written language. Phonology refers to the systems of sounds within a language. Intact phonological awareness allows students to attend to, discriminate, remember, and manipulate sounds at the word, sentence, syllable, and phoneme level (Gillon, 2002). Morphology is the study of words and how they are formed. A morpheme is understood as the smallest unit of language capable of containing meaning (Apel & Werfel, 2014). Children with typical language development master the use of grammatical morphemes by the age of five (Rice, Wexler, & Hershberger, 1998). Pragmatics refers to the rules of language in order to use language appropriately and effectively when conveying a message (Most, Shina-August, & Meilijson, 2010). Poor pragmatic skills also have a significant effect on a child's interpersonal relationships and later, professional relationships. Of particular interest in the current study is the acquisition of syntax for preschool children with hearing loss.

Morphosyntax in Children with Hearing Loss

Syntax is the sentence structure within written and spoken language. A student's understanding of the grammatical structure of a sentence is essential for comprehending written language and for producing grammatically appropriate sentences within spoken language. Syntax is often quite difficult for children with specific language impairment and children with hearing loss (Moeller, et. al., 2010).

More specifically, morphosyntax is a common area of difficulty for children with hearing loss. Morphosyntax refers to the understanding and use of morphemes within an appropriate sentence structure and can be analyzed through written and spoken language. Prior research consistently reveals that children with hearing loss struggle with MLU, typically producing smaller MLUs in spoken language samples than age-matched children with typical hearing (Koehlinger, Van Horne, & Moeller, 2013; Werfel & Douglas, 2017).

By the age of 5, children with typical language development demonstrate the ability to mark tense on lexical verbs with over 90% accuracy (Rice & Wexler, 1996). This means children with typical language development are able to use the appropriate prefixes and suffixes to make a sentence grammatically correct. There is evidence that a gap between children with hearing loss and children with typical hearing occurs with regards to grammatical morpheme production.

Norbury, Bishop, and Briscoe (2001) examined tense marking in elementary school children with mild-to-moderate hearing loss. The results from this study revealed that children with hearing loss produced third-person singular morphemes and regular past tense morphemes less than their age-matched peers with typical hearing. When compared to their language-matched peers with typical hearing, researchers found that children with hearing loss produced third-person singular and regular past tense morphemes with significantly less accuracy.

Another study examined morpheme productions in children with hearing loss compared to MLU-matched peers with normal hearing. The researchers found that children with hearing loss produced possessive –s and plural –s morphemes significantly less frequently compared to their MLU-matched peers with normal hearing. In comparison, the children with hearing loss produced progressive –ing, articles, and irregular past tense verbs more frequently than their MLU-matched peers with normal hearing (McGuckian & Henry, 2007).

Additionally, Werfel (2018) included three groups in order to examine morphosyntax productions in children with hearing loss. The study included a group of children with bilateral hearing loss, an age-matched group of children with normal hearing, and a language-matched group of children with normal hearing. Werfel (2018) found that preschool children with hearing loss demonstrated difficulty in marking plurals, as well as past tense and third person singular verbs, compared to both their age-matched and language-matched children with normal hearing.

To summarize, children with hearing loss tend to experience difficulties with producing grammatical morphemes, specifically with marking plural –s and possessive –s. It is also important to examine and compare children with hearing loss to their age-matched and language-matched peers with normal hearing. We know that a gap in language development exists between children with hearing loss and their same-aged peers with normal hearing. Examining and comparing these groups can present more information on the severity of this gap.

Complex Syntax Development

One of the key language skills necessary for academic success and overall language development is the use of complex syntax in oral and written language (Scott & Windsor, 2000). Complex syntax is defined as two or more verb phrases in one utterance, either through coordination or subordination (Schuele & Dykes, 2004). Complex syntax differs from a complex sentence in that a sentence is more formal. A sentence is a unit of formal, written language, whereas syntax is a unit of spoken language which can be more informal (Barako

& Schuele, 2013). In conversation, it is unnatural to solely speak in complete sentences.

The transition in language development from a simple sentence grammar to complex syntax begins between 2 and 3 years of age (Bloom & Capatides, 1987). This finding accounts for children with typical language development; however, limited information is known about the acquisition of specific types of complex syntax in typically developing children. Complex syntax emerges alongside grammatical morphemes in early development (Barako & Schuele, 2013). It can be examined at length within a language sample or quickly with an elicited task targeting specific types of complex syntax. Addressing complex syntax in treatment will help children with not only oral expression, but also written expression, and might even boost listening and reading comprehension (Barako & Schuele, 2013; Schuele & Dykes, 2004). Research also suggests that the notion that children figure out the details of simple sentences before moving on to complex sentences is false. Rather, once simple sentences emerge (e.g., three word utterances), children simultaneously figure out the details of simple sentences and the details of complex syntax (Barako & Schuele, 2013).

Syntax development is most significant during a child’s preschool years when their mean length of utterance (MLU) is rapidly increasing and they are beginning to form sentences (Leadholm & Miller, 1992). Syntax, however, continues to develop until adulthood (Barako & Schuele, 2013). Interestingly, research has shown that syntactic complexity can be dependent upon the discourse: expository or conversational. Expository discourse is defined as language used for the purpose of providing information. In comparison, conversational discourse is the sharing of ideas, dialogue, comments, and questions. Research has shown a greater use of complex sentences during expository discourse (Nippold, Hesketh, et. al., 2005).

Impact of Complex Syntax on Pragmatic and Academic Skills

Complex syntax is also implicated in pragmatic development. Lederberg & Everhart (2000) found that children with hearing loss displayed less attempts at maintaining a conversation topic, used more instructions and fewer questions, and displayed more difficulty with communication functions. The researchers attributed these difficulties to the overall language delay found in children with hearing loss. Speaking solely in simple sentences does not allow for a pragmatically appropriate conversation to occur (Barako & Schuele, 2013; Most, Shina-August, & Meilijson, 2010). Additionally, it makes portraying emotions, feelings, and thoughts even harder (Barako & Schuele, 2013). These factors can negatively impact a child's language development and social-pragmatic skills.

Children are expected to engage in classroom conversations, answer more abstract questions, and verbally summarize and explain material from kindergarten forward (Barako & Schuele, 2013). In order to participate in school and develop relationships, children are obligated to use complex utterances. Inability to produce complex syntax, or produce it correctly, is hypothesized to negatively impact a child's academic success (Scott & Windsor, 2000; Barako & Schuele, 2013).

Complex Syntax at Age Four in Children with Hearing Loss

In a recent study, complex syntax productions were examined in children with hearing loss at four years of age (Werfel, Reynolds, Hudgins, Castaldo, & Lund, under review). The researchers found that children with hearing loss at age 4 have lower complex syntax density than their same-age peers with normal hearing. Additionally, they found that of the types of complex syntax, the three that were most commonly used at age four in children with hearing loss were coordinated clauses (e.g. I like toys *and* I like animals), subordinated clauses (e.g. I got in trouble *because* I threw the ball), and simple infinitives (e.g. I like *to eat* bananas). Children with hearing loss produced these complex syntax features at less frequency than their age-matched peers but not less than their language-matched peers with normal hearing. Additionally, there were three complex syntax features in which children with hearing loss at age 4 had significantly lower percent accuracy than children with normal hearing: simple infinitives, full propositional complement clauses (e.g. I knew *that* the party was today), and subject relative clauses (e.g. The man *who drove* the car got a ticket). For simple infinitives, children with hearing loss had lower percent accuracy than their age-matched peers but not their language matched peers. One cause for this finding could be that children with lower MLU frequently omit the obligatory “to” marker. For full propositional complement clauses and subject relative clauses, however, children with hearing loss had lower accuracy than their age and language matched peers. Therefore, the complex syntax acquisition of children with hearing loss appears to be not only delayed but also disordered.

Types of Complex Syntax

Different types of complex syntax can be analyzed within a child's syntactic inventory. In typically developing children, complex syntax is developed in spoken language before it is developed in written language. Research has shown that specific types of complex syntax emerge at different stages of development. The distinct types of complex syntax can be broken down into twelve main categories. These twelve categories include coordinate conjunction clauses, subordinate conjunction clauses, reduced infinitives, let's clause, marked infinitives, unmarked infinitives, WH-nonfinite complement clauses, full propositional complements, WH-finite complement clauses, relative clauses, nominal or headless relative clauses, and participle clauses. (Barako & Schuele, 2013). Infinitive clauses are typically the first type of complex syntax to emerge in typically developing children. The other forms of complex syntax that emerge earliest are dependent upon a child's verb knowledge and use (Bloom, Tackeff, & Lahey, 1984).

Purpose

The purpose of this study was to describe the development of complex syntax through the preschool years in children with hearing loss. It was hypothesized that children with hearing loss would produce more attempts at complex syntax with greater accuracy during the preschool years. The following research questions were posed:

1. Do children with hearing loss have increased performance over preschool years on broad measures of complex syntax?

2. What are the developmental trajectories of each specific type of complex syntax in children with hearing loss?

CHAPTER 2

METHODS

Participants

This study involved analysis of data from a larger longitudinal study (Werfel, 2017). For the purpose of this study, data was analyzed from nine children with bilateral sensorineural hearing loss who use amplification. The children all use spoken language as their primary mode of communication and speak English as their primary language. Each child had received, or was currently receiving, services for speech and language development secondary to their hearing loss diagnosis. None of the children had any other documented disabilities.

There were five girls and four boys included in this study. Of these children, six used cochlear implants bilaterally, one used hearing aids bilaterally, and two were bimodal. The average age of identification in these children was 7.28 months and the average age of amplification is 9.44 months. The Primary Test of Nonverbal Intelligence (PTONI; Ehrler & McGhee, 2008) and the Test of Early Language Development, 3rd edition or 4th edition (TELD-3 or TELD-4; Hresko et al., 1999; 2017) were administered to each of the participants at their first testing session. See Table 2.1.

Table 2.1 Nonverbal IQ and TELD Spoken Language Quotient

	Nonverbal IQ	TELD SLQ
Average	110.67	84
Minimum	88	59
Maximum	133	115
Standard Deviation	14.28	21.01

Procedure

Each child was tested on five different occasions. Children were first tested around their fourth birthday and then every six months after that until they were six years old. The children were tested by research assistants or a certified speech-language pathologist who were trained for proper administration of each assessment. A number of standardized measures and norm-referenced measures were administered to each of the children during each testing session. One of the measures administered was a 12-minute language sample using the Hadley Protocol (Hadley, 1998). The Hadley protocol promotes a conversational interview and includes three 4-minute segments: personal narrative, expository, and story retell. The test administrator occasionally used pictures of popular shows/movies and activities to prompt language when they felt it was necessary. Each language sample was audio and video recorded.

Language sampling analyzes spoken language in children in a natural environment. For preschool children, expository language sampling has been proven to elicit language that accurately portrays the child’s abilities (Evans &

Craig, 1992; Masterson & Kamhi, 1991). As previously noted, spoken language typically contains less complex utterances than written language but language sampling can provide a general overview of a child's syntactic inventory in an informal setting.

Once data collection was completed, research assistants in the lab transcribed the language samples. There were three steps to the transcription process before the transcription was entered into Systematic Analysis of Language Transcripts (SALT) (Miller & Iglesias, 2012). In the initial step, the transcriber was instructed to get all the dialogue onto the document. The transcriber included dialogue from both the examiner and the child and anyone else that was involved during the sample, if applicable. In the next step, another transcriber was responsible for "cleaning up" the transcription. They made sure there were no errors and began to code for mazes within the sample. Additionally, marks for utterance overlap and omitted morphemes were made, as well as added gloss lines and contextual notes as needed. Finally, in the third step, an experienced lab member listened to the sample, ensured its accuracy, and gave it its final pass.

SALT is a computer software program that standardizes the process of eliciting, transcribing, and analyzing language samples. Within SALT, clinicians can analyze important clinical markers for language such as MLU, use of grammatical morphemes, use of complex syntax, and others to analyze a child's language skills within a natural sample. For the purpose of this study, the researchers examined the MLU, total utterances, and the frequency and accuracy of complex syntax features within the sample.

Once the samples were transcribed accurately, they were coded for complex syntax [cs] and type by a trained graduate research assistant. See Table 2.2 for specific codes. The codes were double-checked by the director of the lab and then entered into SALT program. The samples were analyzed for presence and type of complex syntax. Any errors found included an error code [err] at the end of the utterance with a gloss line for the adult target.

Table 2.2 Complex Syntax Types

	SALT Code	**Example Utterance**
Coordinated Clause	[cc]	I like toys and I play other games [cs] [cc].
Subordinate Clause	[sc]	I got in trouble because I threw the ball [cs] [sc].
Reduced Infinitive	[cat]	I wanna tell you something [cs] [cat].
Simple Infinitive	[si]	I like to play with my dog [cs] [si].
Unmarked Infinitive	[uic]	Can you help lift this box [cs] [uic]?
Let's Clause	[lc]	Let's play a game [cs] [lc].
Wh- Nonfinite Clause	[wnfc]	She didn't know where to go [cs] [wnfc].
Wh- Finite Clause	[wfc]	She didn't know where she was going [cs] [wfc].
Full Propositional Complement	[fpc]	Mary knew that the party was today [cs] [fpc].
Subject Relative Clause	[src]	The man who drove the car got a ticket [cs] [src].
Object Relative Clause	[orc]	I got the prize that he wanted [cs] [orc].
Oblique Relative Clause	[rc]	I looked at the prize that he wanted [cs] [rc].
Adjunct Relative Clause	[arc]	That is the place where I was born [cs] [arc].

Headless Relative Clause	[hrc]	This is where I put my shoes[cs] [hrc].
Participle Clause	[pc]	I had fun eating marshmallows [cs] [pc].
Other	[other]	Any other instance of complex syntax.

The Standard Measures Report was collected using SALT in order to find the length in utterances of each sample. The Explore function was then used to find each utterance containing a [cs] code, [err] code, and the specific code based on the type of complex syntax (see Table 2.2). Based on the output from the Explore function, the scores of each variable were calculated for each sample. The percentage of correct productions for each type of complex syntax was calculated by dividing the number of utterances with correct productions by the total number of utterances with attempts for each type. For example, if there were four utterances with a correct production of a coordinate clause and one utterance with an errored production of a coordinate clause, four was divided by five to get 80% accuracy. The percentage of complex syntax attempts in each sample was found by dividing the number of attempts by the total number of utterances. To find the percentage of errors, the same method was done, however, the number of errors was divided by the total number of utterances. In order to find the percentage of utterances containing a correct complex syntax feature, the number of utterances containing a correct feature was divided by the total number of utterances. Lastly, the complex density was found by dividing the total number of correct features by the total number of utterances in the sample.

Reliability of Coding

The author of this study coded each sample for complex syntax. After the sample was coded, another research assistant checked the coding for accuracy and completion. The research assistant used Track Changes to make any changes or add codes, if necessary. Any discrepancies were discussed and addressed before the director of the lab reviewed each coded sample. The reliability found for all samples was 88.73%, and final agreement was reached by consensus for all samples.

Reliability was also calculated for the worksheets. The author completed a worksheet for each sample. Then, the director of the lab used a random number generator to choose one sample from each child. The worksheet reliability found was 99.44%.

CHAPTER 3

RESULTS

The present study aimed to describe complex syntax development during the preschool years in children with hearing loss. No significant difference was noted for length of sample in utterances. See Table 3.1.

Table 3.1 MLU, NDW, and Sample Length in Utterances

Child Code		Time 1	Time 2	Time 3	Time 4	Time 5
Participant 1	MLUm	4.73	4.05	5.4	6.46	7.16
	NDW	117	138	131	190	211
	Utterance Length	126	128	84	111	106
Participant 2	MLUm	4.08	3.77	8.1	5.41	7.01
	NDW	121	97	194	169	197
	Utterance Length	113	127	101	134	137
Participant 3	MLUm	2.45	3.11	716	4.82	4.39
	NDW	112	123	187	158	154
	Utterance Length	199	191	111	136	129
Participant 4	MLUm	6.55	6.01	5.78	7.58	6.62
	NDW	208	169	206	177	196
	Utterance Length	112	121	156	107	127
Participant 5	MLUm	2.31	5.19	6.03	9.44	7.13
	NDW	51	145	162	205	190

	Utterance Length	108	127	117	112	140
Participant 6	MLUm	2.68	2.49	4.79	5.09	547
	NDW	79	66	139	165	175
	Utterance Length	194	96	143	129	125
Participant 7	MLUm	4.54	4.06	4.57	4.97	5.73
	NDW	163	166	174	169	217
	Utterance Length	184	132	127	116	151
Participant 8	MLUm	2.38	3.1	3.4	4.88	4.35
	NDW	45	95	83	160	178
	Utterance Length	61	141	93	169	151
Participant 9	MLUm	4.85	7.73	4.84	6.6	6.16
	NDW	138	212	181	186	180
	Utterance Length	115	127	151	121	131

Complex Syntax Productions during Preschool Years

Hierarchical linear models indicated significant gains in percentage of utterances with complex syntax attempts, percentage of utterances with correct complex syntax productions, and complex syntax density. The estimate at each time for each model was calculated using the following formula; Intercept estimate + [number of time points departed from Time 0]*Time estimate. In the models, a one-unit increase in time was equal to a 6-month measurement interval. As seen in Table 3.2, participants produced utterances with complex syntax attempts about three percent between each time point. The percentage of utterances with correct complex syntax productions also increased as time increased, as shown in Table 3.3. Additionally, we found that complex syntax density increased during the preschool years which is displayed in Table 3.4.

Table 3.2 Percent of Utterances Containing Attempts

Predictors	Estimates	CI	p	Estimates	CI	p
Intercept	17.40	13.20-21.59	<0.001	8.58	2.4-14.79	0.011
Time				2.94	1.42-4.45	0.001

Table 3.3 Percent of Utterances Containing Correct Productions

Predictors	Estimates	CI	p	Estimates	CI	p
Intercept	16.35	12.21-20.5	<0.001	7.00	1.03-12.98	0.029
Time				3.12	1.68-4.55	<0.001

Table 3.4 Complex Syntax Density

Predictors	Estimates	CI	p	Estimates	CI	p
Intercept	0.25	0.18-0.32	<0.001	0.09	-0.03-0.21	0.154
Time				0.05	0.02-0.09	0.002

Significant Growth for Specific Types of Complex Syntax

Hierarchical linear models were also examined for each type of complex syntax. Only five types of complex syntax displayed significant growth ($p < .001$) over the preschool years. These five were coordinate clauses, reduced infinitives, simple infinitive, full propositional clauses, and headless relative clauses. The same formula used for complex syntax attempts, correct complex syntax productions, and density was used to find the growth for each of the five types with significant gains. The numbers are displayed in Tables 3.5-3.9. These findings suggest that the participants made significant gains with producing these five types of complex syntax during their preschool years.

Table 3.5 Correct Coordinate Clauses

Predictors	Estimates	CI	p	Estimates	CI	p
Intercept	11.96	7.65-16.26	0.001	0.89	-6.71-8.48	0.820
Time				3.69	1.60-5.78	0.001

Table 3.6 Correct Reduced Infinitives

Predictors	Estimates	CI	p	Estimates	CI	p
Intercept	1.69	0.46-2.92	0.027	-0.48	-2.31-1.35	0.612
Time				0.72	0.27-1.17	0.003

Table 3.7 Correct Simple Infinitives

Predictors	Estimates	CI	p	Estimates	CI	p
Intercept	5.82	4.27-7.38	<0.001	3.36	0.50-6.21	0.027
Time				0.82	0.02-1.62	0.051

Table 3.8 Correct Full Propositional Clauses

Predictors	Estimates	CI	p	Estimates	CI	p
Intercept	1.80	0.79-2.81	0.008	0.47	-1.05-1.98	0.550
Time				0.44	0.07-0.82	0.027

Table 3.9 Correct Headless Relative Clauses

Predictors	Estimates	CI	p	Estimates	CI	p
Intercept	0.40	0.18-0.62	0.001	-0.37	-0.82-0.09	0.121
Time				0.26	0.12-0.39	0.001

CHAPTER 4

DISCUSSION

The purpose of this study was to describe complex syntax development over preschool years in children with hearing loss. The present study findings revealed that complex syntax density does increase over time. Additionally, children with hearing loss did not make a significant number of errors throughout their preschool years. Children with hearing loss also demonstrated significant growth with five types of complex syntax which include coordinate clauses, reduced infinitive clauses, simple infinitives, full propositional clauses, and headless relative clauses.

Complex Syntax Density

At the age of 4 years, children with hearing loss produced utterances with attempts at complex syntax 11.5% of the time. As time increased, we saw the percentage increase by about three percent. From age four to age six, children with hearing loss went from producing utterances with attempts at complex syntax 11.5% of the time to about 23% of the time. Relative to percent of utterances containing correct complex syntax features, we likewise found that as time passed, the percentage of utterances containing a correct complex syntax feature also increased. In addition, the complex syntax density increased for each child as time increased. These findings suggest that children with hearing loss increase in their use of productive complex syntax over the course of the preschool years. Additionally, these findings suggest that from the beginning of preschool years, children with hearing loss do not produce a significant number of complex syntax errors, and this error rate does not change over the two year time period.

This finding is consistent with previous research in which significant growth in complex syntax was found during preschool years. Typically, MLU is rapidly increasing and, in turn, so is the child's complex syntax density (Leadholm & Miller, 1992). Previous research also suggested that children with hearing loss at age four are not producing a significant amount of errors in complex syntax production (Werfel, Reynolds, Hudgins, Castaldo, Lund, under review). This is also consistent with the present study findings.

Complex Syntax Features with Significant Growth

Children with hearing loss displayed growth over the preschool years on only five types of complex syntax. These five were coordinate clauses, reduced infinitive clauses, simple infinitives, full propositional clauses, and headless relative clauses. The feature with the most growth over the two years was coordinate clauses. This finding was unsurprising because coordinate clauses are early developing for children with normal hearing (Schuele & Dykes, 2004; Barako & Schuele, 2013). It also was unsurprising to see growth in reduced infinitives because phonologically reduced words are typically easier for children to produce and especially easier for children with hearing loss to produce. The type of complex syntax that displayed the next highest increase was simple infinitives. This finding was surprising because children with hearing loss typically omit the obligatory “to” marker. Previous research has found that simple infinitives are especially difficult for children with hearing loss (Werfel, Reynolds, Hudgins, Castaldo, Lund, under review). Additionally, previous research revealed that children with hearing loss displayed difficulty producing full propositional clauses due to the omission of the if-complementizer (Schuele & Dykes, 2005).

The significant growth displayed with headless relative clauses was unexpected. Typically relative clauses, in general, are considered later developing in children with typical language development and normal hearing (Schuele & Dykes, 2004; Barako & Schuele, 2013). This finding suggests that there may be a different order of acquisition of complex syntax in children with hearing loss than for children with normal hearing. One hypothesis that could explain the earlier than expected growth in headless relative clauses is that they provide an avenue for children with hearing loss to avoid using a particular target word. We know that children with hearing loss are delayed in vocabulary development and typically have a reduced vocabulary (Lund, 2016). Given this, it is often necessary for them to describe a word for which they may not know the vocabulary term. For example, children may describe a beach as a place *where* they build sandcastles and swim. Additionally, an increased use of headless relative clauses could be the case for children who are unintelligible and have to describe the word they are trying to produce.

Clinical Implications

The present research suggests that it is appropriate to target complex syntax in children with hearing loss during their preschool years. The children with hearing loss in this study were already using complex syntax, and mostly using it correctly. Additionally, it is important to note that although we observed growth in some of the features, that growth was limited. In particular, there was not significant growth in some features that are considered to be early developing for children with typical language development, such as subordinate clauses. This suggests that children with hearing loss are still delayed. Early intervention on complex syntax may be a key approach to closing that gap between children with hearing loss and their same-aged peers with typical hearing.

Further Research

In the future, researchers should consider expanding the current study to further analyze the developmental trajectories of complex syntax in children with hearing loss in comparison with age-matched and language-matched children with normal hearing. Currently, researchers have found that children with hearing loss experience delays with the production of complex syntax, however, it is unclear from the present study if this acquisition is disordered. Further research may provide more insight regarding the types of complex syntax expected at different ages in children with hearing loss.

Additionally, appropriate intervention methods for targeting complex syntax in children with hearing loss should be examined. Currently, research suggests that sentence combining tasks are effective intervention approaches to target complex syntax in children with language disorders and normal hearing (Balthazar & Scott, 2018); however, little is known about whether or not this intervention strategy is appropriate for children with hearing loss. Furthermore, the question of which types of complex syntax to target in which order should be addressed. For example, is it appropriate to target the features that are already showing growth or should clinicians begin targeting and working from the ground-up with the features that are not showing any growth? Further research should evaluate these intervention approaches.

Lastly, given that the present study employed language sampling for testing, the participants displayed their complex syntax inventories in a natural setting. Further research should examine complex syntax production when children are provided with explicit tasks to elicit each type of complex syntax. Participants may avoid some types of complex syntax in language samples, given their inability to produce them correctly, and elicited tasks may reveal more errors within productions. This data could further explain the developmental trajectories and the specific areas of syntax in which children with hearing loss display the most difficulties.

Conclusions

The purpose of this study was to examine the developmental trajectories of complex syntax in children with hearing loss during the preschool years. The findings revealed that throughout preschool years, children with hearing loss are attempting to use complex syntax more frequently. Additionally, our findings indicate that there are a relatively limited amount of errors in complex syntax production from the beginning of their preschool years. This is positive and suggests that complex syntax is appropriate to target during preschool years. Five specific types of complex syntax were found to have significant gains throughout the preschool years: coordinate clauses, reduced infinitives, simple infinitives, full propositional clauses, and headless relative clauses. No other types of complex syntax examined revealed significant gains. Therefore we conclude that complex syntax is emerging over preschool years, however, children with hearing loss are exhibiting a delay and different patterns of acquisition.

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