QUESTION EXPOSURE AND PRODUCTION IN PRESCHOOLERS WHO ARE HARD-OF-HEARING

By

Kellie Jean Carns

A study submitted in partial fulfilment of the requirements for the degree of

MASTER OF SCIENCE IN SPEECH AND HEARING SCIENCES

WASHINGTON STATE UNIVERSITY

May 2015

ACKNOWLEDGEMENTS

I offer my sincerest thanks and gratitude for the invaluable support of all those who guided and encouraged me in the arduous course of completing this study, including:

Thesis Committee

Dr. Mark VanDam

Dr. Nancy Potter

Dr. Charles Madison

Personal Supporters

Benjamin Volchok

Mark Scrudder

Annie Siel

Dr. William Voss

My father, David W. Carns

My mother, Julie Ann Hiersche

And especially, Oscar Stanisläw Power

And countless others

QUESTION EXPOSURE AND PRODUCTION IN PRESCHOOLERS WHO ARE HARD-OF-HEARING

Abstract

By Kellie Carns, M.S.

Washington State University

May 2015

Children who are hard-of-hearing (HH) have been documented to have delays in syntactic question production and comprehension, and they show a greater degree of variability in syntactic skills as compared with their typically developing (TD) peers. Previous studies have shown that parents of TD children alter the content of child-directed speech based on the child's linguistic abilities. The present study examined exposure to questions in young TD children and those with hearing loss (HL), and ask how this exposure relates to question production within and between HH and TD groups. It was predicted that families of HH children would show a different pattern of question use in child-directed speech than families of TD children, and that children with HL would use fewer questions in speech than TD children. Contrary to this prediction, we found no difference in patterns of family or child question use between the HH and TD groups. This work contributes to a better understanding of factors influencing syntactic development in the HH population.

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

Compared with their typically developing (TD) peers, children with hearing loss (HL) are more likely to exhibit language delays in vocabulary (Blamey, 2001), phonological development (Geers & Hayes, 2011), literacy skills (Geers & Hayes, 2011), and syntactic development (Schirmer, 1985). While there is extensive research looking at language development in hard-of-hearing (HH) children, many of the findings may be challenging to generalize to a modern population due to recent advances in assistive technology, successes of early intervention, and a more comprehensive understanding of individual variability (Tuller & Delage, 2014). Furthermore, less recent emphasis has been directed toward the language of children with hearing aids in comparison to those with cochlear implants. This work examines the syntax of questions in HH children and their TD peers. Children' production of questions and exposure to adult questions in these two groups was examined to gain a better understanding of factors affecting the development of question use in the context of HL.

Syntactic movement in questions

In this study we examined four selected syntactic question forms in English, all of which involve syntactic movement. Syntactic movement is a widely accepted linguistic theory used to account for clause structures in many languages. Less derivationally complex syntactic constructions have long been assumed to require less overall processing and to be mastered more

easily (Chomsky, 1995). In general, simpler forms are acquired earlier by children and show more regular usage (Hale, 2011). Syntactic movement, as well as deletion and substitution, are thought to contribute additively to overall complexity in questions (Jakubowicz & Nash, 2001). The question forms described here are ordered by increasing level of syntactic complexity – subject-auxiliary inversion questions, *wh*- subject questions, *wh*- object questions, and *wh*- adjunct questions. It was hypothesized that production and use of these forms will reflect the complexity parsimony predicted in the literature.

Subject-auxiliary inversion (SAI) involves phrasal fronting of the tensed or auxiliary verb. SAI can be seen in the following clauses (adapted from Radford, 1997):

(1) a. *Dorian is* reading a book.
b. *Is Dorian* reading a book?

In this example, clause (1a) is formed first, and then the tensed auxiliary verb undergoes movement to form clause (1b). To form (1b) from (1a), the subject *Dorian* and the auxiliary verb *is* undergo SAI movement. The derivation of (1b) from (1a) is represented graphically as follows, with the arrow representing movement (adapted from Radford, 1997):

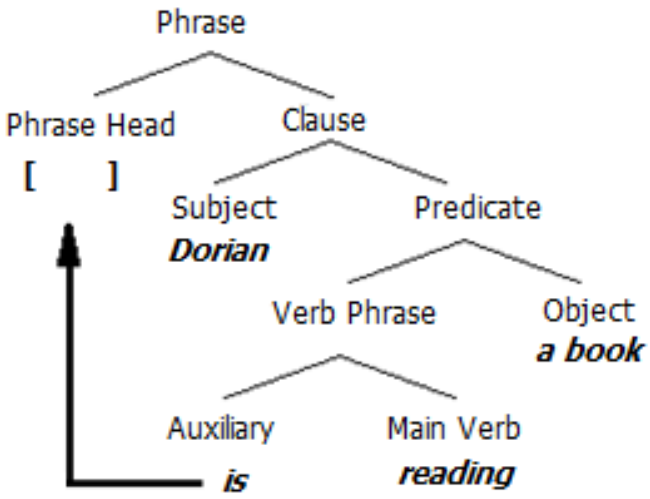

Figure 1 – Subject Auxiliary Inversion

Wh- movement involves the movement of a *wh*- word to the head of a clause. In this type of formation, the *wh*- word serves as a kind of proform, holding the place of the information sought by the asker. Common examples of English *wh*- words are *what, which*, and *how*. The three types of *wh*- movement examined here are *wh*- subject, *wh*- object, and *wh*- adjunct movement.

Wh- subject (*wh*-S) movement is the least complex of these three. *Wh*-S movement involves the subject of a clause being replaced by the *wh*- word and then moving to a phrasal head. Its use in question formation is demonstrated in the following clauses:

(2) a. *Sherlock* is solving the case.
b. *Who* is solving the case?

In this example, clause (2a) is the basic clause from which (2b) is derived. The subject *Sherlock* is replaced by the *wh*- word *who*, which then undergoes movement to the *wh*- *space*, as represented below:

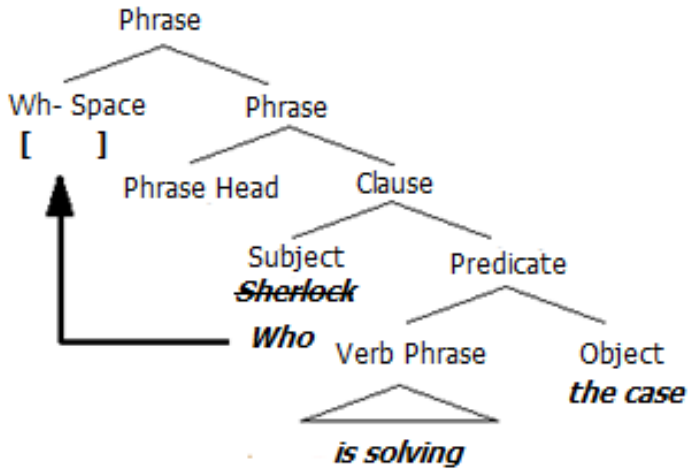

Figure 2 – *Wh*- subject movement

Wh- object (*wh*-O) questions involve a similar but more complex process. In these questions, the *wh*- word replaces the object of a clause. Two syntactic movement steps are involved—completion of SAI and movement of the *wh*- word to the *wh*- space (Radford, 1997). *Wh*-O question formation is demonstrated in clause set 3:

(3) a. The little prince *was* watering *the rose*.
b. The little prince *was* watering *what*?
c. *What was* the little prince watering?

Wh- adjunct (*wh*-A) questions are the most syntactically complex of the four question types examined here. In *wh*-A questions, the *wh*- word replaces an adjunct to a clause. An adjunct is an optional part of a clause which provides additional information and may be placed relatively freely within the clause, such as an adverbial constituent (Ernst, Anderson, & Bresnan, 2001). For example, in the clause, *the bird came to my window in December*, *in December* constitutes an adjunct: its presence is not necessitated by the main verb, it serves to provide additional information, and its syntactic placement is flexible (e.g., *in December the bird came to my window, the bird came in December to my window*.) *Wh*-A question formation involves the same two syntactic steps as *wh*-O question formation: SAI movement occurs followed by movement of the *wh*- word to the *wh*- space. Consider the following clause set:

(4) a. Captain Ahab *is* chasing a whale *across the ocean*.
b. Captain Ahab *is* chasing a whale *where*?
c. *Where is* Captain Ahab chasing a whale?

In (3) above showing *wh*-O movement and in (4) showing *wh*-A movement, clause (a) is the basic clause from which (b) and (c) are, in turn, derived. In clause (b), one constituent—the object *the rose* in (3) and the adjunct *across the ocean* in (4)—is replaced by the *wh*- word, but movement has not yet occurred. This is referred to as an *in situ wh*- question (Jakubowicz,

2011). In clause (c), SAI has been completed, as seen in the transposition of *the little prince* with *was* in (3) and *Captain Ahab* with *is* in (4), and the *wh-* word has undergone movement to the *wh-* space. The derivation of (c) from (a) in (3) is represented graphically as follows:

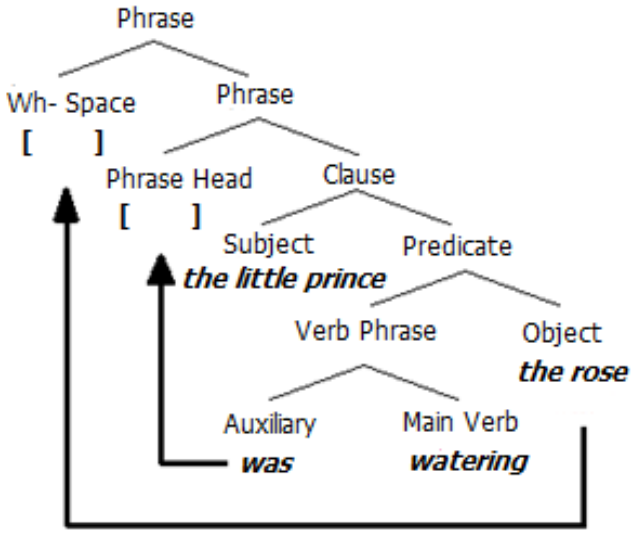

Figure 3 – *Wh-* object movement

The derivation of (c) from (a) in (4) follows a similar pattern, with the adjunct undergoing movement rather than the object, as described above.

These four question forms of increasing complexity–SAI, *wh*-S, *wh*-O, and *wh*-A – and their use in the speech of families of TD and HH toddlers forms the basis of the current research.

Question acquisition in HH and TD children

The relative syntactic complexity of the various question types guides their typical acquisition sequence and results in predictable patterns in the productions of TD children (Bloom, Merkin, & Wootten, 1982; Santelmann, Berk, Austin, Somashekar, & Lust, 2002). In the context of questions, complexity increases with the extent of movement required to formulate the question from the underlying declarative form. TD children use less complex question types

initially and increase complexity with age (Jakubowicz, 2011). Of the *wh*- questions, *in situ* questions are the least syntactically complex because they involve no movement; they are thus commonly found in the speech of both TD and developmentally divergent children just beginning to produce questions (Jakubowicz, 2011). Other consistencies in TD question acquisition have also been noted. One study found that the earliest verb-containing *wh*- question forms (those asking *where* and *what*) typically develop around two years old, with *who, how,* and *why* forms typically produced before a child's third birthday (Bloom et al., 1982). Even when age of production varied, there was little deviation from this sequence. Developmentally, questions formed by SAI appear at roughly the same age that auxiliaries appear in a TD child's declarative sentences (Santelmann et al., 2002). This suggests that the formation of questions via SAI movement alone is not more challenging for TD children than the simpler declarative syntactic structure. *Wh*-S questions are syntactically less complex than *wh*-O questions, the latter requiring movement of the *wh*- word over a longer distance and across syntactic arguments, as shown in Figures 2 and 3 (Jakubowicz, 2011). Unsurprisingly then, subject questions are typically acquired earlier in TD children than object questions (Bloom et al., 1982). All question forms considered here are mastered by the TD child by the age of six (Friedmann & Szterman, 2011).

By contrast, studies of HH children have shown substantial variability in question production performance. Some achieve language development comparable to TD children, while others show deficits ranging from minor to major (Koehlinger, Van Horne, & Moeller, 2013). Specific difficulties in producing and comprehending forms involving syntactic movement have been frequently noted (e.g., Friedmann & Szterman, 2011). Data on HH children's use of SAI is sparse, but *wh*- questions have been previously examined. One

relatively consistent trend is greater deficits with the comprehension and production of object questions than with the less syntactically complex subject questions. In fact, one study noted some HH children incorrectly substituting subject questions for an object questions in production tasks (Friedmann & Szterman, 2011). Although TD children master question forms before starting school, some HH children have shown persistent difficulty and increased variability with these structures (Koehlinger, Van Horne, & Moeller, 2013).

Several studies have attempted to find a link between degree of hearing loss and language ability. Most have failed to find a relationship between hearing threshold and general syntactic delay (Friedmann & Szterman, 2006; Tuller & Delage, 2014). However, one study of French-speaking adolescents with HL did find such relationships (Delage & Tuller, 2007). In that study, greater difficulties in expressive grammar tasks were associated with degree of hearing loss in these participants, but the study did not focus on question formation specifically. Better aided hearing thresholds have been linked to stronger global language and morphosyntactic skills in some HH children based on established measures such as mean length of utterance (MLU) (Koehlinger et al, 2013). However, variability of individual performance and complicating factors such as differing ages of intervention make these results difficult to generalize. Recent study results warrant further exploration of degree of hearing loss as it relates to HH children's expressive and receptive language abilities.

Although degree of HL has not always been examined as a factor, there is mounting evidence of the relationship between language exposure and language production in HH populations as well as in TD groups (Blamey, 2001; Nicholas & Geers, 2006; Hadley, Rispoli, Fitzgerald, & Bahnsen, 2011). The language to which children are exposed often influences patterns of acquisition (Rowland, Pine, Lieven, & Theakston, 2003). We know that adults tailor

question use to the linguistic abilities of the TD child, less frequently directing complex questions toward younger and less verbal children and more frequently directing more sophisticated questions to older and more verbal children (McGinty, Justice, Zucker, Gosse, & Skibbe, 2012). The effects of this may be considerable: content of parental speech accounted for 23-28% of morphosyntactic skill variance in TD toddlers in one study (Hadley et al., 2011). Thus, there is reason to examine the relationship between HH children's question production abilities and the quality and frequency of questions these children are exposed to in their linguistic environment. Whether families of TD children show a different pattern of question input than families of HH children also remains an open question.

Current evidence on question production and syntactic movement in HH children is not comprehensive and may not apply to a hearing impaired child with modern intervention. Most existing studies have focused on school-age HH populations, many of whom did not receive early intervention (e.g., Friedmann & Szterman, 2011). Changes in assistive technology and an increased focus on early intervention has created a new and little-studied population of children with HL who received intervention services earlier than in previous generations. In addition, modern studies have tended to focus on children with greater degrees of HL and those with cochlear implants. In some cases, studies have examined data from children with hearing aids and those with cochlear implants, leading to difficulty identifying the outcomes of one type of technology or intervention (Koehlinger et al., 2013). Considerably less research has been conducted on the language abilities of children with hearing aids specifically, particularly in recent years. No recent studies regarding the question syntax of preschool children with hearing aids are known to exist.

RESEARCH QUESTIONS

The factors affecting the syntactic abilities of children with HL are not well documented. Here, we examine syntactic question formation in TD and HH children, in terms of both productions by the children and questions posed to them or in their auditory environment. The following questions are addressed here:

1. Are HH children exposed to a higher rate of simpler syntactic questions than their TD peers?

2. Is there a relationship between the quantity of syntactic question types to which HH and TD children are exposed and the quantity of questions these children produce?

3. Is there a relationship between degree of hearing loss and the quantity of syntactic questions to which they are exposed?

METHOD

Participants

The present work included 43 families with young children (child mean age = 29.8 months, *SD* = 2.8 months, range = 24-36 months; 58% female). Fourteen families had a child who was typically developing (the TD group) and 29 families had a child with mild-to severe-hearing loss (the HH group). Licensed audiologists with pediatric experience used common, developmentally appropriate audiometry techniques to assess hearing in all children. Children in the TD group passed a hearing screen at 20 dB HL at 500, 1000, 2000, and 4000 Hz in both ears. Hearing thresholds were computed for children in the HH group at 500, 1000, 2000, and 4000 Hz for both ears. Those children had a mean better ear pure tone average (BEPTA) of 47.8 dB HL (SD = 11.7 dB; range: 24-70 dB). All HH children received prompt intervention for their hearing loss and were fitted with amplification at an average age of 5.1 months (SD = 4.1

months). Children were identified with hearing loss at birth via universal newborn hearing screening (UNHS), except for one child identified at one month of age and another identified at six months of age. All children in the HH group wore bilateral air-conduction hearing aids. Children in the HH group had no documented secondary disability.

Socioeconomic status (SES) was determined through self-reported maternal education on an 8-level scale ranging from *no-high-school* to *graduate-degree*. There was no difference between the SES of families with TD or HH children ($t(41)=1.35$, $p>.1$) or between families with boys versus girls ($t(42)=1.54$, $p>.1$). Families identified as white (81%), black (7%), mixed-race (9%), and Asian (3%).

Procedure, data collection

One full-day audio recording of each child's daily environment was collected using the Language ENvironment Analysis (LENA; LENA Research Foundation, Boulder, CO). The LENA device is a compact audio recorder worn in a custom pocket on the child's clothing throughout the day, allowing for naturalistic recording samples from the child's auditory perspective. After a day-long audio record is collected, the LENA automatic speech processing software analyzes the full-day recording and outputs estimates of quantity of adult and child words, number of conversational turns, a variety of other variables, and the actual recorded audio which is accessible for playback (Morehead & Ingram, 1973).

Of particular interest in the present study are the conversational exchanges. Here it was pertinent to assess periods of the day of high conversational activity between parents and target children. The LENA software identifies conversational exchanges—in particular, a segment of vocal activity by a parent adjacent to vocal activity by the child wearing the recorder—and

computes an integer value indicating number of conversational turns. Each conversational turn is uniquely identified at centi-second resolution in an output file with onset and offset markers that correspond to the exact location in the corresponding WAV file. For the present work, we chose to analyze 15 minutes of conversation from each day-long recording. The daily recordings from each family (43 in total) were divided into five-minute segments, and the total number of computed conversational exchanges for each segment was recorded and rank ordered. Then the audio of the three non-adjacent, five-minute segments with the greatest number of conversational turns were extracted. This process yielded a total of 129 five-minute audio samples from the 43 families.

Procedure, transcription

Manual broad transcription was completed for each of the 129 audio samples using Computerized Language ANalysis (CLAN) software (Child Language Data Exchange System, CHILDES, Carnegie Mellon University) and its accompanying transcription format, Codes for the Human Analysis of Transcripts (CHAT). All utterances in each audio sample were transcribed and tagged for talker identity including *mother, father, child,* and *sibling*. Vocal activity such as babbling, yelling, unintelligible, and partially intelligible utterances were included in the transcription using the procedures described in the CHAT manual.

A designated researcher (KC) analyzed each completed transcript and identified all syntactically formed questions produced by speakers other than the child. Each question was then coded for type of syntactic movement (SAI, *wh*-S, *wh*-O, or *wh*-A). These data were used to quantify questions within conversational interactions in order to answer the research questions.

Reliability

Transcribers and coders were blind to each other and the hearing status and demographics of each participant. One judge assessed all 129 samples, and an additional judge evaluated a subset of 20 samples, 8 from the HH group and 12 from the TD group. Quantity of adult SAI, *wh*-S, *wh*-O, and *wh*-A question types and child-produced questions (of all types) were then tallied for each recording in the subset, and the correlations between judges were computed. Correlations were as follows: r_{SAI}=.85, p_{SAI}<.001, $r_{Wh\text{-}S}$=.77, $p_{Wh\text{-}S}$<.001, $r_{Wh\text{-}O}$=.77, $p_{Wh\text{-}O}$<.001, $r_{Wh\text{-}A}$=.93, $p_{Wh\text{-}A}$<.001, r_{child}=.97, p_{child}<.001. Correlations by group (i.e., HH and TD alone) were similar to pooled correlations and all were significant (all p<.001), indicating high inter-rater reliability of transcriptions in the syntactic domain.

Procedure, syntactic analysis

Each transcript was examined for presence of questions. Questions containing SAI, *wh*-S, *wh*-O, and *wh*-A movement were coded for in the speech of parents and other family members. Other question forms such as tag questions and those indicated only by prosody were initially coded for, but were omitted from evaluation due to relative infrequency of those types and challenges developing objective and reliable definitions of these question varieties. A total of 4.05% of questions posed by family members within the LENA recording database were unintelligible to a degree that syntactic category could not be determined. These questions were coded as *category unknown* and were excluded from further analysis.

In children's speech, immature syntactic formations proved to be a barrier in reliably categorizing question types by syntax. Many utterances (e.g., "doggy go?") were consistently coded as questions between transcribers but features such as prepositions and auxiliary verbs

necessary for further syntactic categorization were either lacking or opaque to syntactic analysis. Thus, a single category quantifying all child-produced questions in each recording was used.

Level of syntactic complexity was determined by the distance of phrase movement. Distance correlates with complexity because it indicates greater change from the canonical English Subject-Verb-Object clause order. This movement must be reconciled by the listener in order to interpret the question accurately. A greater distance of movement requires more advanced syntactic skills for comprehension (Friedmann & Szterman, 2011). Clauses containing greater movement distances develop later in the speech of TD children (Bloom et al., 1982). Details of syntactic complexity of each question type are shown in Table 1 below, in ascending order of complexity.

Table 1. Question types, steps in syntactic formation, and examples of these structures

Question Type	Syntactic Formation	Example
Subject Auxiliary Inversion	Auxiliary moves to complementizer head (i.e., inverts). When no auxiliary is present, main verb tense moves to complementizer head and receives "*do* support" (Berent, 1996).	Can you sing that song? Is this your book? Does he like to read?
Subject *Wh*-Movement	Subject of verb phrase (VP) is converted into *wh*- word and undergoes covert movement out of VP to the specifier position of the complementizer phrase (SpecCP) at the clause's head. Auxiliary moves to complementizer head (i.e., inverts) (Bedore & Leonard, 1998).	Who is at the door? What is making that noise? What's the matter?
Object *Wh*-Movement	Object of VP is converted into *wh*- word and moved out of the VP to SpecCP at the clause's head. Auxiliary moves to complementizer head (i.e., inverts) (Bedore & Leonard, 1998).	Where are you going? What shirt will you wear? Who is your favorite author?
Adjunct *Wh*-Movement	New clause, phrase, or word is converted to *wh*- word and placed in SpecCP at the clause's head. Auxiliary moves to complementizer head (i.e., inverts) (Bedore & Leonard, 1998).	Why did she leave? When is the movie? How does this toy work?

RESULTS

The first research question asked whether HH children were systematically exposed to simpler syntactic question constructions by their families. We found no difference between groups in overall number of questions (p>.05) and no difference between groups in any type of question (p>.05). Although we did not observe group differences, there was a trend that the HH group was exposed to fewer of each type of syntactic question we tested here with the exception of *wh*-S questions. These results are illustrated in Figure 4 below.

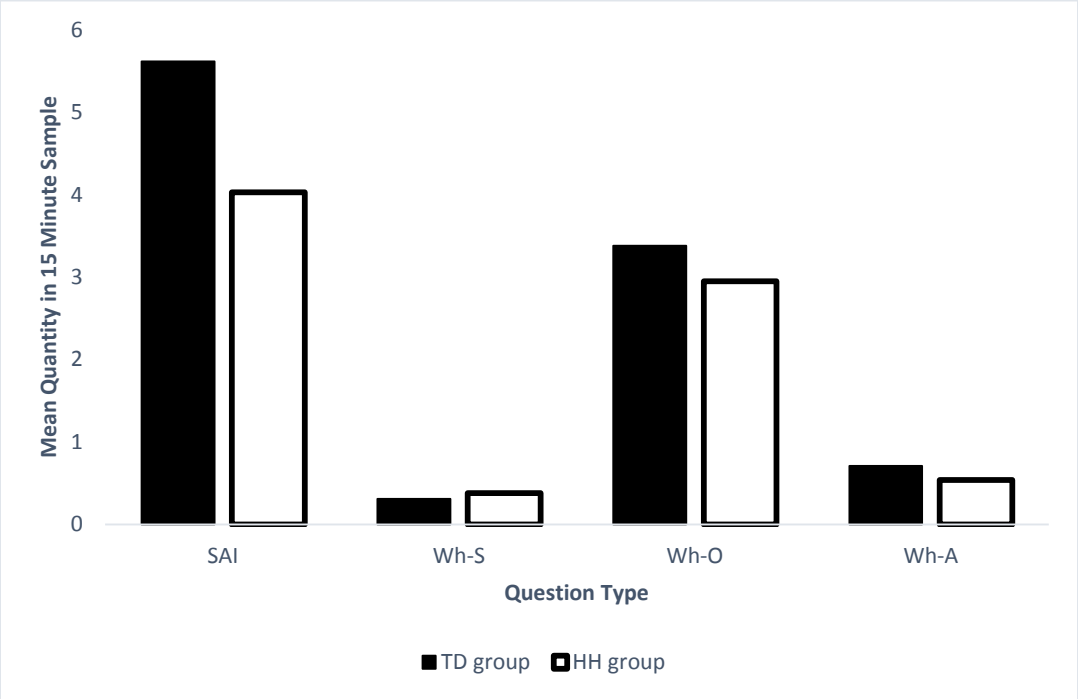

Figure 4. Quantity of exposure to four question types by hearing status

The second research question asked whether a relationship exists between the quantity of syntactic questions to which each group was exposed and the quantity of questions they produced. We found no correlation between these two variables for the TD group (r=.35,

p>.05), HH group (*r*=-.01, *p*>.1), or pooled group (*r*=.14, *p*>.1). These results are illustrated in Figure 5 below.

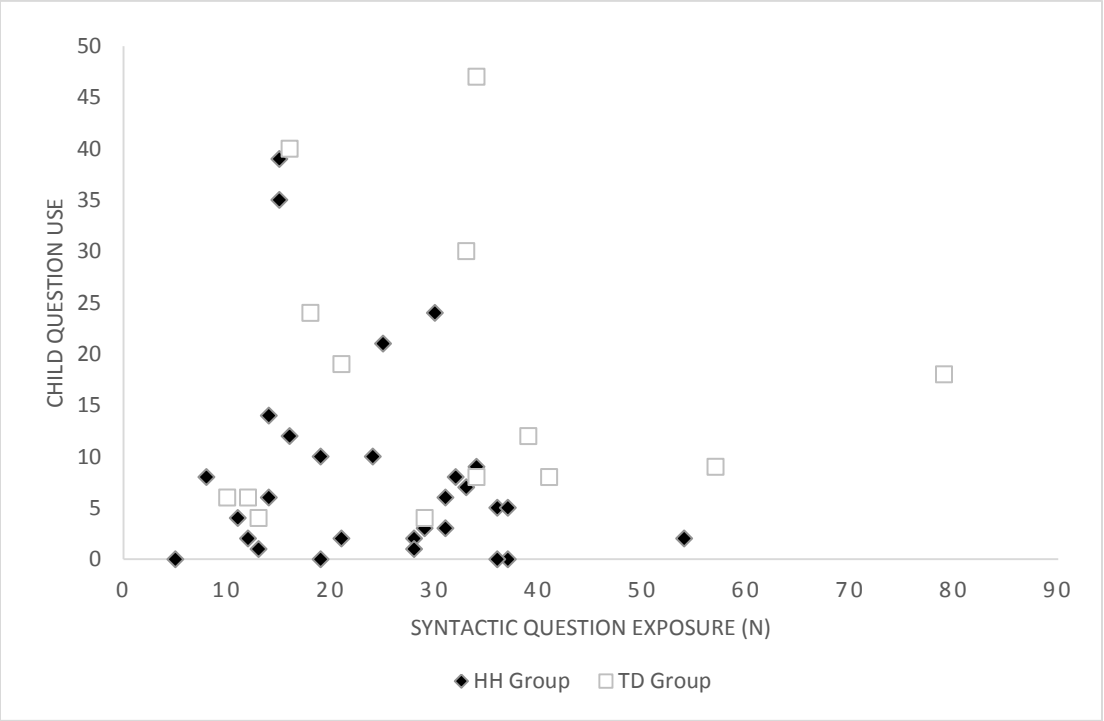

Figure 5. Quantity of child-produced questions as related to syntactic question exposure by hearing status

The third research question asked whether the pure tone average (PTA) hearing thresholds of members of the HH group was related to exposure of syntactic question constructions by family members. The correlation found between degree of hearing loss and the quantity of syntactic question constructions pooled by type to which children were exposed was insignificant (*r*=.15, *p*>.01). These results are illustrated by Figure 6 below.

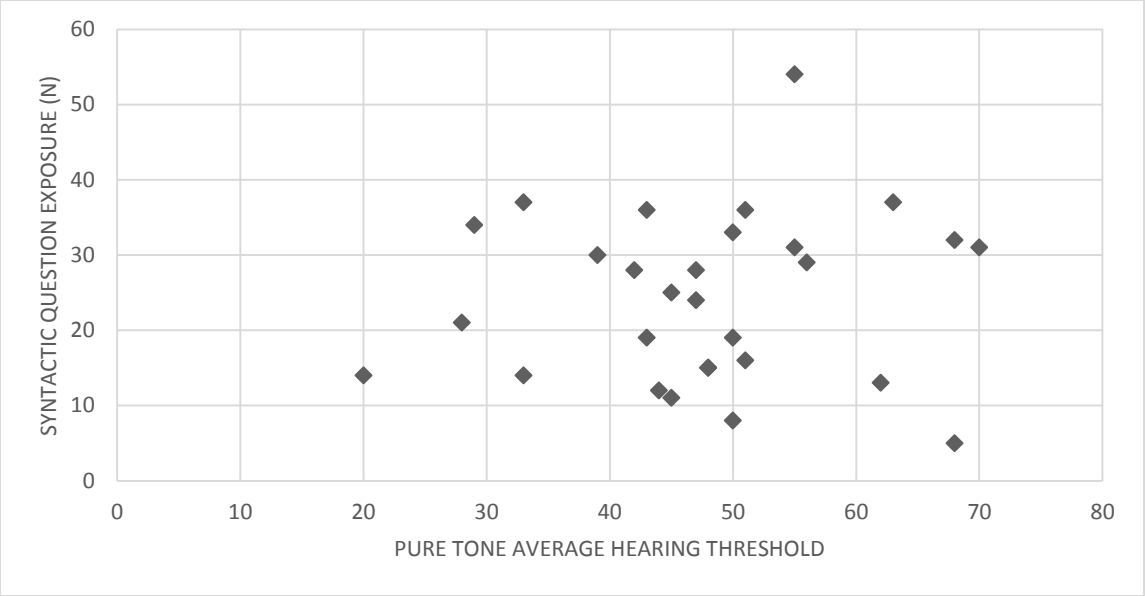

Figure 6: Syntactic question exposure as related to degree of hearing loss in HH group

DISCUSSION

The findings presented here do not document a difference in the quantity of questions to which HH children were exposed compared to their TD peers. Although the mean rate of exposure to each question type trended lower in the HH group, this difference was not statistically significant. We did not find a relationship between the quantity of questions to which a child was exposed and the quantity the child produced in either group or in the pooled group. We did not find a relationship between better-ear aided PTA and syntactic question exposure. Overall our findings suggest that family members may not alter the frequency of type or overall quantity of questions used in response to a child's hearing loss, a conclusion contrary to our expectations.

The principal findings demonstrating no difference in syntactic output or input on any measure are unexpected for several reasons. Parents of a variety of atypical populations have been shown to alter the quality and quantity of child-directed language in previous reports (e.g.,

McGinty et al., 2012 [SLI]; Thiemann-Bourque, Warren, Brady, Gilkerson, & Richards, 2013 [Down syndrome]). While these populations differ from HH children in numerous ways, they do show the common factor of having generally delayed receptive and expressive language skills. Also surprising was the lack of correlation between syntactic question exposure and question production in children. There is an extensive body of literature tying language input to output (Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991), a pattern which was not observed in the present data. Several possible explanations exist for these unexpected findings.

It may be that the young age of the sample children in this study (mean age = 29.8 months) relative to previous studies examining syntax in HH children serves to explain the lack of difference between the HH and TD groups. Theoretically, the language exposure of these two groups could diverge at a later age than studied here, resulting in future differences. An alternative explanation is that modern trends in early intervention for HL combined with advances in assistive hearing technology have led to question use with HH children roughly on par with their TD peers. It has been shown that past generations of HH children received syntactic question input that differed significantly from TD children and that these differences in input impacted later expressive language skills (Blamey, 2001; Nicholas & Geers, 2006). Our finding of no significant difference in the quantity of questions produced by HH children suggests that later deficits in question use may not be explained solely by a lack of expressive practice of these forms in childhood.

To conclusively explain the current findings, further research into syntax exposure and use by modern HH and TD children and their families is required. The less frequent exposure to each question type in the HH group, while not found to be statistically significant here, is also

worth further examination. Specific aspects of syntactic development have long been shown to correlate with overall language development measures in children (e.g., Morehead & Ingram, 1973; Gavin, Klee & Membrino, 1993; Bedore & Leonard, 1998). Thus, difference in the syntax acquisition pattern of a population would be important to identify in order to implement effective intervention and ultimately better understand this population.

The findings presented in this study suggest that HH children without other documented disabilities do not experience deficient syntactic question input relative to TD peers. Furthermore, they perform similarly to TD peers in question production rate. Assessing syntactic output may be a tool to identify or classify children with hearing loss secondary to additional disabilities. This would require established norms and extensive validation, but critical aspects of the tool are already in place, and current speech-language pathology practice includes the ability to perform broad transcriptions suitable for syntactic analyses.

Fully- or partially-automatic methods for assessing language abilities expand possible scope of use. This report uses mixed methodology incorporating LENA automatic speech recognition with traditional, manual broad transcription techniques. Automation and semi-automation allow for broad application and may aid in the assessment process if and when diagnostic markers can be identified in the syntax of HH children.

LIMITATIONS

One limitation to the present research was the difficulty inherent in analyzing the speech of young children. Due to the often fragmented, phonologically simplified, and telegraphic nature of toddlers' speech, reliably classifying the children's questions into syntactic categories

proved impractical. This limits our ability to draw conclusions regarding expressive syntax in those children.

The results of this study require further examination to be fully explained. Many possible factors could be at play, including the implementation of universal newborn hearing screenings, advances in technology, socioeconomic status, parental education and support, and a number of other possibilities. Analysis of such factors is necessary to definitively interpret our findings.

FUTURE DIRECTIONS

Longitudinal studies are warranted to better understand the impact of early intervention and technological advances on language use and exposure in this population. Analysis of the relationship between demographic information (e.g., race, child sex, parent sex, birth order) and language development in HH children has not been extensively investigated.

Unless a retrospective study of previous HH generations is to be conducted, the possibility of intervention and technology changes impacting the syntactic input and production of HH children remains speculative. Longitudinal studies of the syntactic development of contemporary HH children may provide some clarity on this issue. Specifically, it remains to be seen whether such advances will result in more typical syntax use across the HH individual's lifespan. For this reason, we feel that further research on the syntactic development of this new population of early intervention recipients is strongly warranted.

References

Bedore, L. M. & Leonard, L. B. (1998). Specific language impairment and grammatical morphology: A discriminant function analysis. *Journal of Speech, Language, and Hearing Research, 41(5),* 1185-1192.

Berent, G. P. (1996). Learnability constraints on deaf learners' acquisition of English wh-questions. *Journal of Speech and Hearing Research, 39,* 625-642.

Blamey, P. J. et al. (2001). Relationships among speech perception, production, language, hearing loss, and age in children with impaired hearing. *Journal of Speech, Language, and Hearing Research, 44(2),* 264-285.

Bloom, L., Merkin, S., & Wootten, J. (1982). Wh- questions: Linguistic factors that contribute to the sequence of acquisition. *Child Development, 53(4),* 1084-1092.

Child Language Data Exchange System. (n.d.). Using CLAN. Retrieved March 1, 2015 from http://childes.psy.cmu.edu/clan.

Chomsky, N. (1995). *The Minimalist Program.* Cambridge, MA: MIT Press.

Delage, H. & Tuller, L. (2007). Language development and mild-to-moderate hearing loss: Does language normalize with age? *Journal of Speech, Language, and Hearing Research, 50,* 1300-1313.

Ernst, T. B., Anderson, S. R., & Bresnan, J. (2001). *Syntax of Adjuncts.* Cambridge, England: Cambridge University Press.

Friedmann, N. & Szterman, R. (2006). Syntactic movement in orally-trained children with hearing impairment. *Journal of Deaf Studies and Deaf Education, 11(1),* 56-75.

Friedmann, N. & Szterman, R. (2011). The comprehension and production of Wh-questions in

deaf and hard-of-hearing children. *Journal of Deaf Studies and Deaf Education, 16(2),* 212-235.

Gavin, W. J., Klee, T., & Membrino, I. (1993). Differentiating specific language impairment from normal language development using grammatical analysis. *Clinical Linguistics and Phonetics, 7(3),* 191-206.

Geers, A. E. & Hayes, H. (2011). Reading, writing, and phonological processing skills of adolescents with 10 or more years of cochlear implant experience. *Ear and Hearing, 32(1),* 9S-59S.

Hadley, P. A., Rispoli, M., Fitzgerald, C., & Bahnsen, A. (2011). Predictors of morphosyntactic growth in typically developing toddlers: Contributions of parent input and child sex. *Journal of Speech, Language, and Hearing Research, 54(2),* 549-566.

Huttenlocher, J., Haight, W., Bryk, A., Seltzer, M., & Lyons, T. (1991). Early vocabulary growth: Relationship to language input and gender. *Developmental Psychology, 27(2),* 236-248.

Huttenlocher, J., Vasilyeva, M., Cymerman, E., & Levine, S. (2002). Language input and child syntax. *Cognitive Psychology, 45,* 337-374.

Jakubowicz, C. (2011). Measuring derivational complexity: New evidence from typically-developing and SLI learners of L1 French. *Lingua, 121(3),* 339-351.

Jakubowicz, C., & Nash, L. (2001). Functional categories and syntactic operations in (ab)normal language acquisition. *Brain and Language, 77,* 321-339.

Koehlinger, K. M., Van Horne, A. J. O., & Moeller, M. P. (2013). Grammatical outcomes of 3- and 6-year-old children who are hard of hearing. *Journal of Speech, Language, and Hearing Research, 56,* 1701-1714.

McGinty, A. S., Justice, L. M., Zucker, T. A., Gosse, C., & Skibbe, L. E. (2012). Shared-reading dynamics: Mothers' question use and the verbal participation of children with SLI. *Journal of Speech, Language, and Hearing Research, 55(4),* 1039-1052.

Morehead, D. M. & Ingram, D. (1973). The development of base syntax in normal and linguistically deviant children. *Journal of Speech, Language, and Hearing Research, 16,* 330-352.

Nicholas, J. G. & Geers, A. E. (2006). Effects of early auditory experience on the spoken language of deaf children at 3 years of age. *Ear and Hearing, 27(3),* 286-298.

Radford, A. (1997). *Syntax: A minimalist introduction*. Cambridge, England: Cambridge University Press.

Rowland, C. F., Pine, J. M., Lieven, E. V. M., & Theakston, A. L. (2003). Determinants of acquisition order in wh-questions: Re-evaluating the role of caregiver speech. *Journal of Child Language, 30(3),* 609-635.

Santelmann, L., Berk, S., Austin, J., Somashekar, S., & Lust, B. (2002). Continuity and development in the acquisition of inversion in yes/no questions: Dissociating movement and inflection. *Journal of Child Language, 29(4),* 813-842.

Schirmer, B. R. (1985). An analysis of the language of young hearing-impaired children in terms of syntax, semantics, and use. *American Annals of the Deaf, 130(1),* 15-19.

Thiemann-Bourque, K. S., Warren, S. F., Brady, N., Gilkerson, J., & Richards, J. A. (2014). Vocal interaction between children with Down syndrome and their parents. *American Journal of Speech-Language Pathology, 23(3),* 474-485.

Tuller, L. & Delage, H. (2014). Mild-to-moderate hearing loss and language impairment: How are they linked? *Lingua, 139,* 80-101.