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Research Note

Is One Ear Good Enough? Unilateral Hearing Loss and Preschoolers' Comprehension of the English Plural

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Purpose: The plural is one of the first grammatical morphemes acquired by English-speaking children with normal hearing (NH). Yet, those with hearing loss show delays in both plural comprehension and production. However, little is known about the effects of unilateral hearing loss (UHL) on children's acquisition of the plural, where children's ability to perceive fricatives (e.g., the /s/ in *cats*) can be compromised. This study therefore tested whether children with UHL were able to identify the grammatical number of newly heard words, both singular and plural.
Method: Eleven 3- to 5-year-olds with UHL participated in a novel word two-alternative forced choice task presented on an iPad. Their results were compared to those of 129 NH 3- to 5-year-olds. During the task, children had to choose whether an auditorily presented novel word was singular (e.g., *tep, koss*) or plural (e.g., *teps, kosses*) by touching the appropriate novel picture.
Results: Like their NH peers, children with UHL demonstrated comprehension of novel singulars. However, they were significantly less accurate at identifying novel plurals, with performance at chance. However, there were signs that their ability to identify novel plurals may improve with age.
Conclusion: While comparable to their NH peers at identifying novel singulars, these results suggest that young children with UHL do not yet have a robust representation of plural morphology, particularly on words they have not encountered before.

Children's ability to perceive subtle cues from the language spoken to and around them is crucial for their linguistic development. For this reason, children with hearing loss are at a greater risk of language delay than their normal-hearing (NH) peers (e.g., Vohr et al., 2008; Wake et al., 2004). While there has been much focus on children with bilateral hearing loss (BHL), there is growing evidence that children with unilateral hearing loss (UHL) are also at risk of language delay (José et al., 2014; Lieu et al., 2010).

UHL is defined as NH in one ear accompanied by a hearing loss in the other (e.g., > 15 dB HL PTA at 500 Hz, 1 kHz, and 2 kHz; Bess et al., 1998, 1986). Despite affecting roughly 3%–5% of school-aged children (Bess et al., 1998; Niskar et al., 1998), UHL has historically received limited clinical attention, perhaps due to the commonly held misconception that *one ear is good enough* (Tharpe, 2008). However, UHL can have wide-ranging effects on children's developing social skills (Laugen et al., 2017), academic achievement (Kuppler et al., 2013; Most, 2004), and overall quality of life (Borton et al., 2010).

There is also increasing evidence that children with UHL are at a particular risk of falling behind in language development. Even before their first birthday, many children with UHL are already behind their NH peers in their listening and oral communication skills (Kishon-Rabin et al., 2015). There is also growing evidence that both primary school–aged children (Lieu et al., 2010) and adolescents (Fischer & Lieu, 2014) with UHL perform below their NH peers on measures of language comprehension and expression, although the language scores for some appear to improve over time (Lieu et al., 2012). What is less clear is how UHL affects children's early linguistic representations, essential for building a robust grammatical system. This study therefore explored the effect of UHL on preschoolers'

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comprehension of one of the earliest acquired grammatical morphemes in English, the plural.

The plural is one of the first grammatical morphemes acquired by NH children (Brown, 1973; Davies et al., 2017). However, young children with BHL are often delayed in their use of the plural (Koehlinger et al., 2015; McGuckian & Henry, 2007). A recent study by Davies et al. (2020) suggests that this is partly due to difficulty in acquiring *productive representations* of plural morphology, possibly due to limited input/experience with these hard to perceive word-final fricatives. Even if perceived, it is not enough to know that a word such as *cats* means "more than one cat"; children must develop an understanding that the word is composed of two morphemes, a referent and the plural (e.g., *cat* + *s*). Having a productive representation of plural morphology is knowing that other plural words also have this structure (e.g., *tops* = top + s, *wombats* = wombat + s), including words never heard before (e.g., *teps* = tep + s). Davies et al. (2020) demonstrated that 3- to 5-year-olds with NH know that novel words such as *teps* are plural, but that children with BHL did not.

Acoustically, /s/ (e.g., *cats* /kæts/) and /z/ (e.g., *dogs* /dɔgz/) are high-frequency sounds with low intensity (Jongman et al., 2000), making them less perceptually salient and difficult for those with HL to perceive (Pittman & Stelmachowicz, 2003). Indeed, this low perceptual salience is argued to contribute to difficulties children with developmental language delay experience in acquiring English morphosyntax (e.g., the surface hypothesis; see Leonard et al., 1997). While children with UHL have normal access to sound in one ear, and perform similarly to their NH peers on speech recognition tasks in optimal listening conditions (Sargent et al., 2001), the loss of binaural hearing puts them at a disadvantage in adverse listening conditions, such as in the presence of noise and reverberation (Sargent et al., 2001; Welsh et al., 2004). This unreliable access to these already hard-to-hear fricatives may result in inconsistent input, meaning the plural morpheme is only perceived some of the time. That is, sometimes they hear "*two dogs*," while other times they might hear "*two dog*." This inconsistent input could make acquiring representations of productive plural morphology a challenge.

To explore this possibility, we analyzed data testing knowledge of plural morphology from 11 children with UHL, collected as part of a larger study on children with HL (cf. Davies et al., 2020). We then compared their data with the previously reported Davies et al. (2020) performance by NH children. We predicted that children with UHL would show lower comprehension abilities than that of their NH peers, but that this would improve with age.

Method

Participants

The NH controls were 129 English-speaking monolingual children (66 girls, 63 boys) aged 3–5 years (36–67 months, *M* = 48.9 months, *SD* = 7.8 months), attending preschool in Sydney, Australia. Parents/guardians reported none had any suspected or diagnosed hearing loss. To help ensure that the controls were representative of normal language development, all NH children included in the study passed the Preschool Language Scale–Fifth Edition Language Screener appropriate for their age (Zimmerman et al., 2011).

The UHL group was composed of 11 English-speaking children (five girls, six boys) also aged 3–5 years (36–64 months, *M* = 48.7 months, *SD* = 10.4 months). All were reported to have been diagnosed with UHL prelingually, detected as a result of Australian newborn hearing screening (King, 2010). All received listening and spoken language early intervention. The children with UHL had a four-frequency binaural average loss ranging from 3.8 to 27.5 dB[1] (*M* = 14.2 dB, *SD* = 8.2 dB), with the average four-frequency loss in their affected ear (left ear = 5, right ear = 6) ranging from 53.8 to 100 dB (*M* = 78.9 dB, *SD* = 17.9 dB). Individual-ear four-frequency average loss information for children with conductive losses (i.e., UHL-03, UHL-05, UHL-06) was unable to be supplied by their language intervention providers. Two participants used no device. Four were fitted with cochlear implants, two with hearing aids and three with bone-anchored hearing aids. All device fittings were reported as being optimized as part of the child's regular audiological services. There were no clinical concerns for any child regarding access to speech sounds at conversational levels (55–65 dBA). All children with UHL came from English-speaking homes (though UHL-03 and UHL-10 had some exposure to other languages). No participant had any diagnosed additional needs. All clinical and demographic information was provided by their language intervention provider with written parental consent (see Table 1).

Equipment

The experiment was performed on an Apple iPad Air 2. Children in the NH group wore Sennheiser HD 280 Pro headphones. Children in the UHL group were presented auditory stimuli out of a GENELEC 8020A active monitoring loudspeaker.

Auditory Stimuli and Preparation

The auditory stimuli were produced by a female native speaker of Australian English. Each stimulus item was presented within the carrier phrase: *touch the [target].* The target word was either a real word (i.e., *bat/s, pig/s, mop/s, crab/s, horse/s, bus/es*, and *rose/s*) or a novel word. The 24 novel words (see Table 2) all contained Australian English short vowels (Harrington et al., 1997) and early-acquired onset stops (Smit et al., 1990).

All stimuli were recorded using Cool Edit Pro 2.0 (at 48 kHz) and then spliced using Praat (Boersma & Weenink,

[1]All subsequent hearing loss in this research note is reported as average dB HL PTA at 500 Hz, 1 kHz, 2 kHz, and 4 kHz.

Table 1. Participant demographic and clinical information.

ID	Sex	Age (months)	Loss type	Laterality	Device	Age (months) at first HA fitting	Age (months) at CI switch-on	Left-ear 4 frequency average loss (dB HL)	Right-ear 4 frequency average loss (dB HL)	Binaural 4 frequency average loss (dB HL)	Age (months) started early intervention
UHL-01	M	49	Sensorineural	R	CI		31	0	90		36
UHL-02	F	60	Mixed	R	None			3.8	92.5	3.8	3
UHL-03	F	51	Sensorineural	L	None			53.8	8.8	27.5	44
UHL-04	M	41	Conductive[a]	R	BAHA	0				11.3	11
UHL-05	M	36	Conductive[a]	L	BAHA	1				11.3	9
UHL-06	M	36	Conductive[a]	R	BAHA	3				12.5	15
UHL-07	M	63	Sensorineural	L	HA	0		55	0	13.8	40
UHL-08	F	53	Sensorineural	L	HA			91.3	0	15	39
UHL-09	F	64	Sensorineural	R	CI		59	15	> 100	15	56
UHL-10	F	42	ANSD	R	CI	0	41	0	81.3	22.5	10
UHL-11	M	41	Sensorineural	L	CI	20	29	67.5		23.8	24

Note. HA = hearing aid; CI = cochlear implant; M = male; R = right ear; F = female; L = left ear; BAHA = bone-anchored hearing aid; ANSD = auditory neuropathy spectrum disorder.

[a]These are permanent conductive losses (e.g., atresia), not transient middle ear issues (e.g., otitis media with effusion).

2016) to control for phonetic variation. The same carrier phrase (i.e., *Touch…*) was spliced onto each item. For the monosyllabic plural trials (see Table 2), the same word stem (e.g., *mop, tep,* etc.) was spliced into both singular and plural versions. One recorded version of the plural coda-cluster (i.e., /ps/, /bz/) was spliced on the plural forms, where appropriate. For the disyllabic plural trials (see Table 2), differences in the vowel and fricative durations between the monosyllabic (e.g., *koss, bus*) and disyllabic forms (e.g., *kosses, buses*) meant different recordings of the singular and plural word stems were used. However, the same recorded version of the syllabic plural /əz/ was spliced onto each plural form.

Visual Stimuli

The visual stimuli contained cartoon pictures of 14 real (*bat, bear, bug, bus, cake, crab, horse, house, mop, pig, rat, rose, snake,* and *tree*) and 48 novel animals/objects. These were used to construct singular and plural picture arrays. The singular arrays displayed a single cartoon picture. The plural picture arrays displayed five smaller instances of a cartoon picture. The singular and plural arrays were matched for surface area.

Table 2. Novel words used in test trials.

Monosyllabic plural trials		Disyllabic plural trials	
Singular	**Plural**	**Singular**	**Plural**
tep /tep/	*teps* /teps/	*koss* /kɔs/	*kosses* /kɔsəz/
bip /bɪp/	*bips* /bɪps/	*nass* /næs/	*nasses* /næsəz/
dup /dɐp/	*dups* /dɐps/	*poss* /pɔs/	*posses* /pɔsəz/
mup /mɐp/	*mups* /mɐps/	*dass* /dæs/	*dasses* /dæsəz/
noop /nʊp/	*noops* /nʊps/	*bess* /bes/	*besses* /besəz/
gop /gɔp/	*gops* /gɔps/	*giss* /gɪs/	*gisses* /gɪsəz/
pab /pæb/	*pabs* /pæbz/	*nizz* /nɪz/	*nizzes* /nɪzəz/
tib /tɪb/	*tibs* /tɪbz/	*kezz* /kez/	*kezzes* /kezəz/
geb /geb/	*gebs* /gebz/	*mozz* /mɔz/	*mozzes* /mɔzəz/
mub /mɐb/	*mubs* /mɐbz/	*tizz* /tɪz/	*tizzes* /tɪzəz/
koob /kʊb/	*koobs* /kʊbz/	*dozz* /dɔz/	*dozzes* /dɔzəz/
tob /tɔb/	*tobs* /tɔbz/	*pazz* /pæz/	*pazzes* /pæzəz/

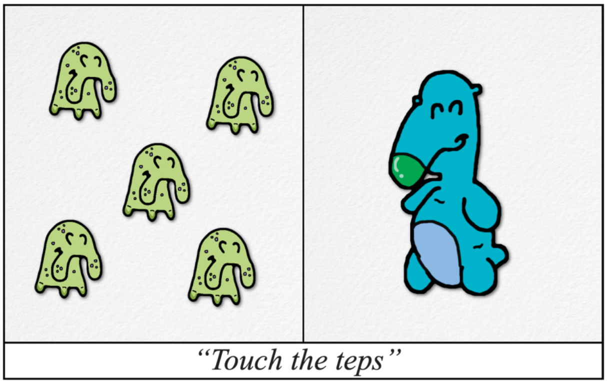
Procedure

The children in the UHL were tested in a quiet therapy room by their speech therapist as part of a regular intervention session wearing their hearing devices for those that used them. The stimuli were presented via loudspeaker, set up 1 m away (headphones are not practical over hearing devices). Before the task began, children had to listen and repeat the plurals /s/ and /əz/ spliced from the stimuli. The volume was adjusted until the therapist was convinced that both could be heard, with the participant either repeating or describing the sound (e.g., /s/ sounds like a snake). For the NH group, /s/ was presented at ~50 dBA and /əz/ at ~55 dBA. For the UHL group, /s/ was presented at ~50–60 dBA and /əz/ at ~55–65 dBA.

During each trial, a singular and a plural picture array were displayed side by side. They were matched for animacy and novelty, but depicted different animals/objects. The auditory stimulus played automatically after 2 s, telling children to "*touch the [target].*" The target word was either real or novel. The novel words were either singular or plural. The child selected either the singular or plural picture array by touching it. The selected picture flashed, and a chirrup sound played, regardless of whether or not the target was selected. During the task, no positive or negative feedback was given to the children; however, positive encouragement was provided if they appeared shy.

There were 24 novel word trials that tested children's comprehension of plural morphology (see Figure 1). An additional seven real word trials kept children engaged in the

Figure 1. Example novel word trial.



task and ensured that they were paying attention rather than randomly selecting pictures.

Ethical Approval

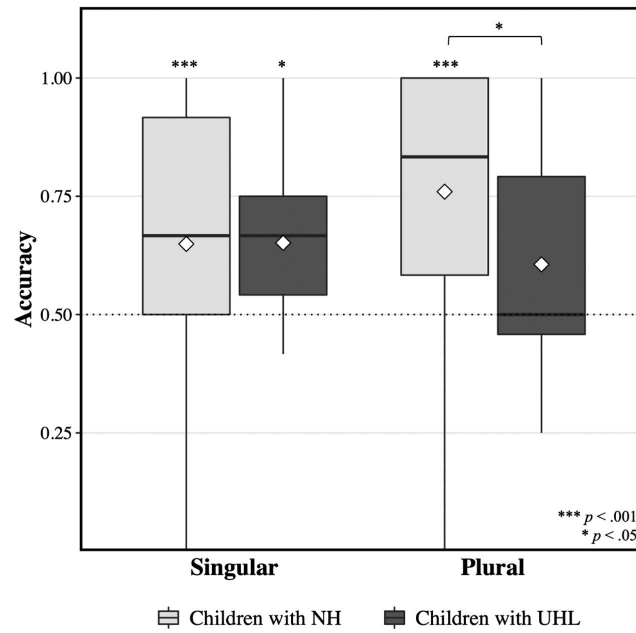
Ethical approval was granted by the Macquarie University Faculty of Human Sciences Ethics Committee (Ref: 5201401065).

Results

To check that children understood the task, planned *t* tests were used to compare their mean accuracy in the real word trials to chance (0.5). As reported in Davies et al. (2020), NH children's accuracy was significantly above chance, $t(128) = 43.48$, $p < .001$, $d = 4.30$, $M = 0.95$, $SD = 0.01$, 95% CI [0.84, 0.96]. As expected, the children with UHL were also significantly above chance, $t(10) = 14.25$, $p < .001$, $d = 3.83$, $M = 0.92$, $SD = 0.03$, 95% CI [0.86, 0.99], demonstrating that they understood the task and were paying attention.

Due to the small sample size, a Shapiro–Wilk normality test was performed on the UHL data to ensure normal distribution (W = .93, $p = .10$). Planned *t* tests were then carried out to compare mean accuracy to chance (0.5) for the singular and plural novel word trials. Alpha was set to .05. Multiple comparisons (2) were controlled for by adjusting *p* values using the Bonferroni method. The NH children were significantly above chance for both singular, $t(128) = 6.40$, $p < .001$, $d = 1.12$, $M = 0.65$, $SD = 0.02$, 95% CI [0.60, 0.70], and plural, $t(128) = 12.76$, $p < .001$, $d = 0.56$, $M = 0.76$, $SD = 0.02$, 95% CI [0.72, 0.80], novel trials. However, while the children with UHL were significantly above chance for the novel singular trials, $t(10) = 2.80$, $p = .04$, $d = 0.85$, $M = 0.65$, $SD = 0.05$, 95% CI [0.53, 0.77], they were no different to chance for the novel plural trials, $t(10) = 1.38$, $p = .40$, $d = 0.41$, $M = 0.60$, $SD = 0.08$, 95% CI [0.43, 0.78]. This suggests that, as a group, the children with UHL were unable to identify the grammatical number of plural words (see Figure 2). A paired *t* test comparing the accuracy for the monosyllabic and disyllabic plural trials for the children with UHL returned a medium-to-large effect size, but found no significant difference, $t(10) = 1.40$, $p = .20$, $d = 0.72$, 95% CI [−0.11, 0.51].

Figure 2. Accuracy on singular and plural novel word trials for children with normal hearing (NH) and children with unilateral hearing loss (UHL; ***$p < .001$; *$p < .05$). The center lines show the median values; the box limits show second and third quartile values; the whiskers show first and fourth quartile values; means are shown as diamonds.



To compare the accuracy of the children with UHL to their NH peers, a binomial generalized linear mixed-effects model was fitted over the novel test trials. Children with NH were predicted to be more accurate than the children with UHL. The logistic model was fitted using the *glmer* function in the *lme4* package (Bates et al., 2015) in *R*. Fixed effects and interactions (intercepts underlined) were *Group* (NH, UHL) and *Number* (singular, plural). Random intercepts were included for *Participant* and *Age in months*.[2] The model returned a significant intercept ($z = 6.03$, $p < .001$). A significant main effect was found for *Number* ($z = 7.30$, $p = .001$). No main effect was found for *Group* ($z = -0.06$, $p = .95$). However, there was a significant interaction between *Group* and *Number* ($z = -2.99$, $p < .01$). This interaction was explored through a post hoc analysis using pairwise comparisons with Tukey's honestly significant difference alpha corrections (the *lsmeans* package in *R*; Lenth, 2016). For the novel singular trials, no significant difference was found between the NH ($M = 0.65$) and UHL ($M = 0.65$) groups ($z = 0.34$, $p = .74$). However, for the plural novel trials, the children with NH ($M = 0.76$)

[2]*glmer*(Accuracy~Group × Number + (1|ID) + (1|Age_months), family = binomial, data = data, control = glmerControl(optimizer = "bobyqa")).

were significantly more accurate than those with UHL (M = 0.61, z = 2.45, p = .01; see Figure 2).

Pearson correlation tests were carried out to explore the relationship between age and accuracy over the singular and plural novel word trials for children with UHL. Multiple comparisons (2) were controlled for by adjusting p values using the Bonferroni method. As previously shown (Davies et al., 2020, 2019), NH children's comprehension of novel singular words did not improve with age, $r(127) = .15$, $p = .09$, 95% CI [−0.02, 0.32], but their accuracy for the novel plurals did, $r(127) = .42$, $p < .001$, 95% CI [0.27, 0.55]. For the children with UHL, there was no improvement in accuracy over age for the novel singular trials, $r(9) = .35$, $p = .57$, 95% CI [−0.31, 0.79], yet the novel plural trials trended toward significance, $r(9) = .64$, $p = .07$, 95% CI [0.06, 0.90]. However, this nonsignificance is arguably due to power limitations of this small sample size (note the pre-adjusted value of $p = .04$ and a 95% confidence interval that does not cross zero; see Figure 3).

Discussion

This study employed a two-alternative forced choice task using novel words to investigate the effects of UHL on children's developing representations of plural morphology. NH children could determine that a novel word such as *teps* was composed of both a referent and a plural morpheme (*tep* + *s*) and was therefore plural. In contrast, as a group, the children with UHL could not.

Despite their performance as a group, there was some indication that plural comprehension for the children with UHL may improve with age. This is broadly consistent with previous research on UHL language outcomes (Lieu et al., 2012). While the correlation between age and accuracy only trended toward significance, two of the older children with UHL correctly identified all novel plurals, suggesting that (at least some) children with UHL may eventually catch up to those with NH. This warrants further investigation.

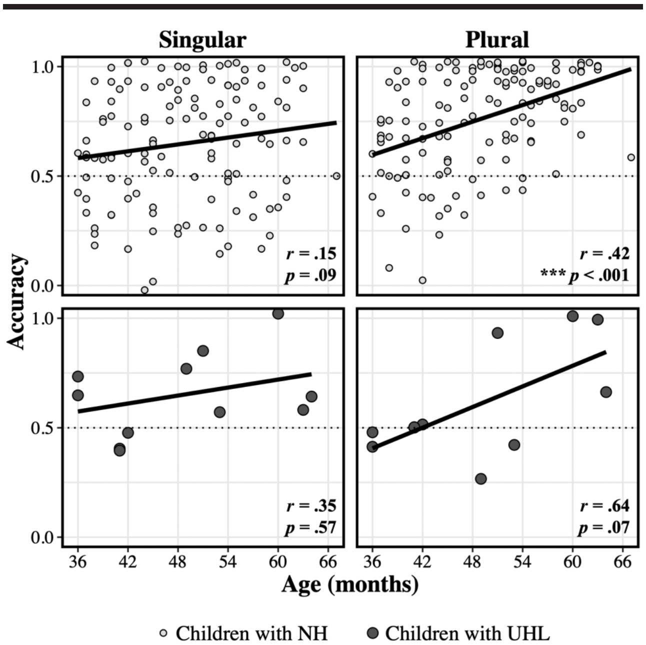
One positive finding was that children with UHL were able to identify novel singulars. Their performance was no different to that of NH children. Furthermore, children with UHL showed little variability, suggesting that their representations of *singular* morphosyntax are as robust as that of their NH peers. This pattern of singular before plural is important, since NH children show comprehension of the *plural* at 2 years, with comprehension of the singular only appearing later at 3 years (e.g., Davies et al., 2017). This provides further support for the possibility that children with hearing loss may acquire knowledge of grammatical number in a manner different to their NH peers (Davies et al., 2020).

It should be noted that these findings are from a small sample of children with UHL who are receiving speech therapy. Although therapy is not uncommon for children with UHL in Australia, this sample may be overrepresentative of those with language difficulties. Future research with a larger sample of children with UHL is needed to determine the generalizability of these results, investigating potential effects of type and degree of hearing loss, as well as differences between hearing devices.

These findings suggest that some children with UHL should not necessarily be assumed to have language development on par with their NH peers (Fischer & Lieu, 2014; Lieu et al., 2012, 2010). These results illustrate how any loss of hearing may affect children's language development in ways that might not be entirely obvious from their speech. It is unclear if and how the difficulties with plural morphology found here might affect the acquisition of other areas of English morphosyntax (e.g., subject–verb agreement, tense marking) and/or language processing more generally, potentially leading to poorer academic (Kuppler et al., 2013; Most, 2004) and social outcomes (Laugen et al., 2017). These results therefore have important implications for early intervention and amplification for children with UHL (McKay et al., 2008).

In sum, this study shows that, to acquire a robust knowledge and use of language, children need to reliably perceive hard-to-hear linguistic cues. Having access to the full spectrum of speech sounds in only one ear may not be enough to mitigate the risks of atypical language development. Thus, when it comes to acquiring the plural, one ear may not be enough.

Figure 3. Pearson's correlations between accuracy and age in singular and plural novel word trials for children with normal hearing (NH) and children with unilateral hearing loss (UHL).



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References

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software, 67*(1), 1–48. https://doi.org/10.18637/jss.v067.i01

Bess, F. H., Dodd-Murphy, J., & Parker, R. A. (1998). Children with minimal sensorineural hearing loss: Prevalence, educational performance, and functional status. *Ear and Hearing, 19*(5), 339–354. https://doi.org/10.1097/00003446-199810000-00001

Bess, F. H., Tharpe, A. M., & Gibler, A. M. (1986). Auditory performance of children with unilateral sensorineural hearing loss. *Ear and Hearing, 7*(1), 20–26. https://doi.org/10.1097/00003446-198602000-00005

Boersma, P., & Weenink, D. (2016). *Praat: Doing phonetics by computer* (Version 6.0.18) [Computer program]. http://www.praat.org/

Borton, S. A., Mauze, E., & Lieu, J. E. C. (2010). Quality of life in children with unilateral hearing loss: A pilot study. *American Journal of Audiology, 19*(1), 61–72. https://doi.org/10.1044/1059-0889(2010/07-0043)

Brown, R. (1973). *A first language: The early stages*. Harvard University Press.

Davies, B., Xu Rattanasone, N., Davis, A., & Demuth, K. (2020). The acquisition of productive plural morphology by children with hearing loss. *Journal of Speech, Language, and Hearing Research, 63*(2), 552–568. https://doi.org/10.1044/2019_JSLHR-19-00208

Davies, B., Xu Rattanasone, N., & Demuth, K. (2017). Two-year-olds' sensitivity to inflectional plural morphology: Allomorphic effects. *Language Learning and Development, 13*(1), 38–53. https://doi.org/10.1080/15475441.2016.1219257

Davies, B., Xu Rattanasone, N., Schembri, T., & Demuth, K. (2019). Preschoolers' developing comprehension of the plural: The effects of number and allomorphic variation. *Journal of Experimental Child Psychology, 185,* 95–108. https://doi.org/10.1016/j.jecp.2019.04.015

Fischer, C., & Lieu, J. (2014). Unilateral hearing loss is associated with a negative effect on language scores in adolescents. *International Journal of Pediatric Otorhinolaryngology, 78*(10), 1611–1617. https://doi.org/10.1016/j.ijporl.2014.07.005

Harrington, J., Cox, F., & Evans, Z. (1997). An acoustic phonetic study of broad, general, and cultivated Australian English vowels. *Australian Journal of Linguistics, 17*(2), 155–184. https://doi.org/10.1080/07268609708599550

Jongman, A., Wayland, R., & Wong, S. (2000). Acoustic characteristics of English fricatives. *The Journal of the Acoustical Society of America, 108*(3), 1252–1263. https://doi.org/10.1121/1.1288413

José, M. R., Mondelli, M. F. C. G., Feniman, M. R., & Lopes-Herrera, S. A. (2014). Language disorders in children with unilateral hearing loss: A systematic review. *International Archives of Otorhinolaryngology, 18*(2), 198–203. https://doi.org/10.1055/s-0033-1358580

King, A. M. (2010). The national protocol for paediatric amplification in Australia. *International Journal of Audiology, 49*(Suppl. 1), S64–S69. https://doi.org/10.3109/14992020903329422

Kishon-Rabin, L., Kuint, J., Hildesheimer, M., & Roth, D. A.-E. (2015). Delay in auditory behaviour and preverbal vocalization in infants with unilateral hearing loss. *Developmental Medicine & Child Neurology, 57*(12), 1129–1136. https://doi.org/10.1111/dmcn.12812

Koehlinger, K., Van Horne, A. O., Oleson, J., McCreery, R., & Moeller, M. P. (2015). The role of sentence position, allomorph, and morpheme type on accurate use of s-related morphemes by children who are hard of hearing. *Journal of Speech, Language, and Hearing Research, 58*(2), 396–409. https://doi.org/10.1044/2015_JSLHR-L-14-0134

Kuppler, K., Lewis, M., & Evans, A. K. (2013). A review of unilateral hearing loss and academic performance: Is it time to reassess traditional dogmata? *International Journal of Pediatric Otorhinolaryngology, 77*(5), 617–622. https://doi.org/10.1016/j.ijporl.2013.01.014

Laugen, N. J., Jacobsen, K. H., Rieffe, C., & Wichstrøm, L. (2017). Social skills in preschool children with unilateral and mild bilateral hearing loss. *Deafness & Education International, 19*(2), 54–62. https://doi.org/10.1080/14643154.2017.1344366

Lenth, R. V. (2016). Least-squares means: The R package lsmeans. *Journal of Statistical Software, 69*(1), 1–33. https://doi.org/10.18637/jss.v069.i01

Leonard, L. B., Eyer, J. A., Bedore, L. M., & Grela, B. G. (1997). Three accounts of the grammatical morpheme difficulties of English-speaking children with specific language impairment. *Journal of Speech, Language, and Hearing Research, 40*(4), 741–753. https://doi.org/10.1044/jslhr.4004.741

Lieu, J. E. C., Tye-Murray, N., & Fu, Q. (2012). Longitudinal study of children with unilateral hearing loss. *The Laryngoscope, 122*(9), 2088–2095. https://doi.org/10.1002/lary.23454

Lieu, J. E. C., Tye-Murray, N., Karzon, R. K., & Piccirillo, J. F. (2010). Unilateral hearing loss is associated with worse speech-language scores in children. *Pediatrics, 125*(6), e1348–e1355. https://doi.org/10.1542/peds.2009-2448

McGuckian, M., & Henry, A. (2007). The grammatical morpheme deficit in moderate hearing impairment. *International Journal of Language & Communication Disorders, 42*(Suppl. 1), 17–36. https://doi.org/10.1080/13682820601171555

McKay, S., Gravel, J. S., & Tharpe, A. M. (2008). Amplification considerations for children with minimal or mild bilateral hearing loss and unilateral hearing loss. *Trends in Amplification, 12*(1), 43–54. https://doi.org/10.1177/1084713807313570

Most, T. (2004). The effects of degree and type of hearing loss on children's performance in class. *Deafness & Education International, 6*(3), 154–166. https://doi.org/10.1179/146431504790560528

Niskar, A. S., Kieszak, S. M., Holmes, A., Esteban, E., Rubin, C., & Brody, D. J. (1998). Prevalence of hearing loss among children 6 to 19 years of age: The third national health and nutrition examination survey. *JAMA, 279*(14), 1071–1075. https://doi.org/10.1001/jama.279.14.1071

Pittman, A. L., & Stelmachowicz, P. G. (2003). Hearing loss in children and adults: audiometric configuration, asymmetry, and progression. *Ear and Hearing, 24*(3), 198–205. https://doi.org/10.1097/01.AUD.0000069226.22983.80

Sargent, E. W., Herrmann, B., Hollenbeak, C. S., & Bankaitis, A. E. (2001). The minimum speech test battery in profound unilateral hearing loss. *Otology & Neurotology, 22*(4), 480–486. https://doi.org/10.1097/00129492-200107000-00012

Smit, A. B., Hand, L., Freilinger, J. J., Bernthal, J. E., & Bird, A. (1990). The Iowa articulation norms project and its Nebraska replication. *Journal of Speech and Hearing Disorders, 55*(4), 779–798. https://doi.org/10.1044/jshd.5504.779

Tharpe, A. M. (2008). Unilateral and mild bilateral hearing loss in children: Past and current perspectives. *Trends in Amplification, 12*(1), 7–15. https://doi.org/10.1177/1084713807304668

Vohr, B., Jodoin-Krauzyk, J., Tucker, R., Johnson, M. J., Topol, D., & Ahlgren, M. (2008). Early language outcomes of early-identified infants with permanent hearing loss at 12 to 16 months of age. *Pediatrics, 122*(3), 535–544. https://doi.org/10.1542/peds.2007-2028

Wake, M., Hughes, E. K., Poulakis, Z., Collins, C., & Rickards, F. W. (2004). Outcomes of children with mild-profound congenital hearing loss at 7 to 8 years: A population study. *Ear and Hearing, 25*(1), 1–8. https://doi.org/10.1097/01.AUD.0000111262.12219.2F

Welsh, L. W., Rosen, L. F., Welsh, J. J., & Dragonette, J. E. (2004). Functional impairments due to unilateral deafness. *Annals of Otology, Rhinology & Laryngology, 113*(12), 987–993. https://doi.org/10.1177/000348940411301209

Zimmerman, I. L., Steiner, V. G., & Pond, R. E. (2011). *Preschool Language Scale–Fifth Edition (PLS-5)*. The Psychological Corporation. https://doi.org/10.1037/t15141-000