

Profiling hearing aid use in school-age children with mild-to-moderate hearing loss

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INTRODUCTION

Successful early hearing detection and intervention has created significant positive impacts on the speech and language outcomes of children with hearing loss (CHL).^{1,2} Importantly, the scope of early intervention for CHL includes promoting consistent, full-time use of hearing technology to support speech and language outcomes; however, research extending to consistency of hearing aid (HA) use beyond age seven years is scant.³

A recent study revealed that longer, more frequent HA use is found as children mature from birth to early childhood (7 years of age).³ This is particularly true for children with more severe hearing loss and children from families with a high maternal education level. Although considerable focus is centered around early amplification of CHL, much less is understood about the subsequent HA use patterns of school-age children with mild-to-moderate hearing loss (MMHL).

PURPOSE

To investigate HA device usage patterns in school-age children with MMHL.

To explore factors affecting patterns of HA use in this population. Age, degree of hearing loss, parent report of age of identification, and parent report of age of amplification fitting will be examined.

METHODS

Children ages 6-12 years were recruited as part of a larger, ongoing study examining listening effort and fatigue in school-age CHL. All children were monolingual English speakers and spent at least two hours per day in a general education classroom. Children with a diagnosis of ADHD, cognitive impairment, autism, or other developmental disorders were excluded. All children had mild-to-moderate hearing loss, bilaterally.

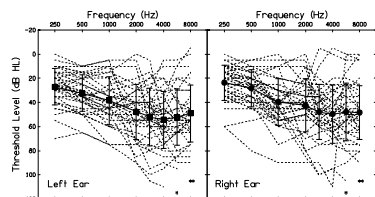


Figure 1. Hearing threshold levels (in dB HL) as a function of frequency (Hz) for the right and left ears of the participants. Dotted lines represent individual participants. Solid lines represent the group average and error bars represent ± 1 standard deviation (SD) in each ear. Asterisks indicate "no response" measured for participants at the limits of the audiometer.

HA use was documented in two ways for each participant.

- Parents reported an estimate of their child's average HA use time during typical school-days.
- Participants' classrooms were visited by a research assistant on two typical school days. Each day, the research assistant observed the child for approximately 10 minutes at 10:00 am and 2:00 pm to document if the child was wearing his/her HAs. The following classifications were assigned to each child:
 - Nonuser – never observed using HAs
 - Variable user - observed 1-3 times using HAs
 - Consistent user - observed all 4 times using HAs

RESULTS

Table 1: Summary of demographic information for study participants.

Variable	Participants
Number of participants	35
Mean (SD) age at observation	10.1 (1.9) years
Mean (SD) age of HL identification	5.3 (3.1) years
Mean (SD) age of amplification	6.3 (3.2) years
Number of males	16
Mothers who completed high school	32
Mean (SD) daily HA use time during school day as reported by the parent	6.1 (2.7) hours

Figure 3: Percentage of children in each age group in the consistent use (green) and non-use (blue) groups. Digits indicate the number of children in each group within the noted age-range.

- Most consistent HA use was observed in children ages 6-9 years. Of children in this age range, 86% were found to be consistent users.
- Only 48% of 10-12 year old children with MMHL were observed wearing HAs consistently.
- Three of the four children who were variable users (Figure 2) were 10-12 years old.

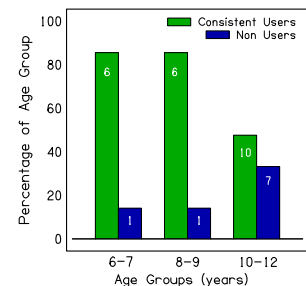


Figure 5. Hearing threshold levels (in dB HL) as a function of frequency (Hz) for the consistent user (left panel) and non-user (right panel) groups. Dotted lines represent individual participants. Solid lines represent the group average and error bars represent ± 1 SD in each ear. Asterisks indicate "no response" measured for participants at the limits of the audiometer.

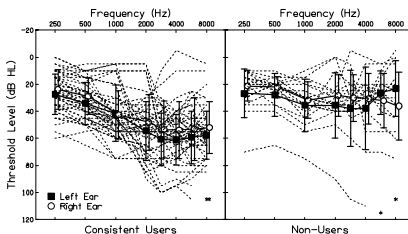


Figure 2: Patterns of HA use based on four classroom observations.

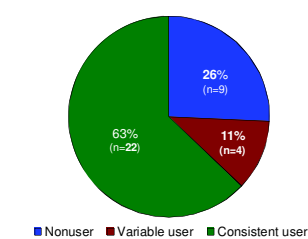
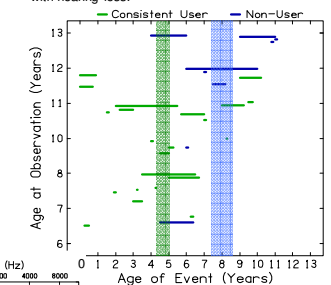


Figure 4: Visual representation of audiologic history for consistent users (green) and non-users (blue). Each dash begins at the parent-reported age of diagnosis and ends at the age of amplification. Data are organized by age during the time of observation. Shaded boxes illustrate the mean age of diagnosis and fitting for each group.

- Hearing loss severity, as measured by the better-ear four-frequency pure-tone average (4-PTA re:500, 1000, 2000, 4000 Hz), was not significantly associated with a child's age of hearing loss identification ($r = -.19$) or age of amplification fitting ($r = -.22$).

One-Way Analyses of Covariance revealed:

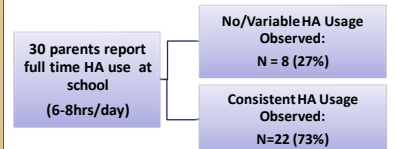
- Children who were observed consistently wearing their HAs were identified with hearing loss earlier than those who were never observed wearing their HAs ($p < .05$), regardless of hearing loss severity (4-PTA).
- Consistent users were fit with HAs earlier than children who were never observed wearing their devices ($p < .05$), regardless of their hearing loss severity (4-PTA) and when they were identified with hearing loss.



A mixed design ANOVA using thresholds averaged across ears for each frequency showed that consistent users had poorer thresholds when compared to non-users ($p < .006$). Post-hoc independent group *t*-tests showed these group differences were apparent for frequencies 3000-8000 Hz.

RESULTS

Figure 6: Parent report of full time HA use during school compared to observed HA use in the classroom.



Of the eight non-users and variable users for whom parents reported full-time HA use, seven were 10-12 years old. Reports from the five parents who indicated that their child did not wear HAs in the classroom were confirmed, as none of these children were observed using HAs.

DISCUSSION

The following factors were found to potentially affect HA use in the classroom:

- Age.** Older children (10-12yrs old) are at risk for infrequent device use, with only 48% of older children observed consistently wearing HAs in their classroom. This is consistent with recent findings from a nationwide study.⁴
- Hearing history.** Non-users were later to be identified with hearing loss and were first fit with amplification later in life compared to consistent users.
- Hearing sensitivity.** Children with better pure tone thresholds from 3000-8000Hz are more likely to not use HAs in the classroom.

Future longitudinal studies are needed to help disentangle the relative contribution of these, and potentially other factors, which may influence consistency of hearing aid use in children.

Of the 35 children with MMHL enrolled in this study, **only one child met all three Early Hearing Detection and Intervention (EHDI) 1-3-6 guidelines** for screening, diagnosis, and intervention of hearing loss.

Among parents who report their child to be using HAs at school, a significant portion may overestimate the consistency of HA use in the classroom, particularly for older children. Because our data suggest a potential lack of parental awareness of HA use patterns at school, **it is essential for EHDI professionals to discuss with parents the importance of maintaining consistent HA use as their child becomes older.**

There is need for counseling regarding the importance of HA device use to continue as children enter elementary school. **Early intervention providers should use this information to better inform parents as they transition to school-based services.** Additionally, service providers in the schools (speech language pathologists, deaf educators, teachers) should be sensitized to these findings and be alerted to monitor device usage in the classroom, especially during pre-adolescence.

KEY REFERENCES

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