

Hearing Aid and Hearing Assistive Technology Non-Use in Classrooms: A Survey of Teachers of the Deaf, Audiologists, and Speech-Language Pathologists

Kimberly Peters, PhD¹, Karen Anderson, PhD²

¹Department of Communication Sciences and Disorders
Western Washington University
516 High Street MS 9171
Bellingham, Washington 98225
(360)-650-3206
Kimberly.peters@wwu.edu

²Director, Supporting Success for Children with Hearing Loss

ABSTRACT

Consistent hearing technology use is important for spoken language development for children who are deaf or hard of hearing (DHH). Schools need to be aware of risk factors for technology non-use in order to ensure that IEP and 504 accommodations are implemented and enforced throughout a child's education. The goal of this study was to describe use and non-use patterns of personal and classroom hearing assistive technology (HAT) for children who are DHH across a wide grade range. Eighty-six itinerant teachers of the deaf, educational audiologists, and speech language pathologists completed an anonymous online questionnaire about hearing aid and FM/DM (frequency modulation/digital modulation) use patterns for their caseloads during one academic year. Data for 1863 students, pre-K through 11th grade, were analyzed. Findings were consistent with previous research showing a high HAT non-use rate among school-age children who are DHH. Peaks for non-use for bilaterally aided children were kindergarten, 3rd, 6th, and 8th grade, with 6th grade being the most likely grade for hearing aid and FM/DM non-use. The predominant reason for non-use was social pressure; although children who spent more time with DHH peers were less likely to reject amplification.

INTRODUCTION

The importance of early identification and management of pediatric hearing loss is well documented in the literature (Ching, et al., 2013; Koehlinger, Van Horne, & Moeller, 2013; Moeller, 2000; Sininger, Grimes & Christensen, 2010; Stiles, Bentler, & McGregor, 2012; Yoshinaga-Itano, Sedey, Coulter, & Mehl, 1998). Early and consistent auditory access to the acoustic cues for speech is critical for spoken language acquisition for children who are deaf (Sharma, Spahr, Dorman & Todd, 2002) or hard of hearing (Dokovic, et al., 2014; Moeller, et al., 2010; Tomblin, et al., 2015; Walker, Holte, et al., 2015). Best practices for management of pediatric hearing loss suggest that children be screened for hearing loss no later than 1 month of age, assessed by a pediatric audiologist no later than 3 months of age, and fit

with appropriate amplification and enrolled in early intervention no later than 6 months of age (Joint Committee on Infant Hearing, 2007). Audiologists recommend that school-age children who are DHH wear their hearing technology "during all waking hours" in order to develop spoken language at a typical rate compared to hearing peers and be successful in the classroom (Tomblin, Oleson, Ambrose, Walker & Moeller, 2015). Recent studies suggest that hours of use and appropriateness of hearing aid fitting (matching of targets to degree of hearing loss) positively influence vocabulary and morpho-syntactic development in preschoolers and school-age children who are hard of hearing (Tomblin, et al., 2015; Walker, Holte, et al., 2015).

Components of a free and appropriate public education

The Individuals with Disabilities Education Act (IDEA), Title II of the Americans with Disabilities Act (ADA) and Section 504 of the Rehabilitation Act of 1973 (Section 504) provide guidance on the obligations of public schools to meet the needs of children with disabilities. Per IDEA 2004, schools are required to provide a free and appropriate public education (FAPE) to all students, including those with disabilities (CFR Section 300.101). When the Individualized Education Program (IEP) team determines that amplification use is a necessary component for FAPE to occur, it is included in the child's IEP.

Students with sensory impairments such as hearing loss are also covered by Section 504 of the Rehabilitation Act, regardless of their eligibility for special education and related services under the IDEA. Section 504 regulations require that students with disabilities have an equal opportunity to participate in school and that they receive FAPE, consisting of regular or special education and related aids and services designed to meet their individual educational needs as adequately as the needs of nondisabled students (Pardeck, 2002). Per ADA Title II, an IEP or a 504 plan must consider the level of access, or effectiveness of communication, as compared to peers; schools must ensure that communication with children who are deaf is as effective as communication with children who are typically developing (Anderson, 2017). Consistent amplification and classroom assistive technology use is a central component of communication effectiveness and is fundamental to ensuring

educational equity for children who are DHH. If students who are DHH are at risk for rejecting amplification, then IEP teams should include provisions within specialized instruction to educate parents and teachers about the importance of full-time hearing aid usage, and develop student skills for coping with the social issues that can arise when their peer group becomes a focus. If the student is *not* wearing amplification, then the IEP team should meet to review and discuss needed accommodations and supports.

Hearing aid non-use in the pediatric population

It is clear from recent research that a high percentage of school age children who are DHH resist wearing their hearing aids full time (see Munoz & Hill, 2015, for a review of the literature from 2008-2012). Direct observation of children in school showed that approximately one quarter of children in elementary and middle school were not wearing their hearing aids (Gustafson, Davis, Hornsby, and Bess, 2015). In a study of 290 children with mild to severe hearing loss across a wide age range (preschool through elementary school), 36% of parents reported that their children wore their hearing aids for fewer than four hours per day (Walker, McCreery, et al., 2015); in this study, hearing aid use time increased as children got older. Additionally, parents significantly overestimated hearing aid use, consistent with other studies (Munoz et al, 2014; Gustafson, Ricketts, & Tharpe, 2017). Research suggests that parents of children with mild losses tend to overestimate hearing aid use to a greater extent (Walker, McCreery, et al., 2015), as do parents of children in upper elementary grades (Gustafson, et al., 2015).

In addition to school age children, infants, toddlers, and preschoolers have been shown to be inconsistent technology users. Munoz, Blaiser, and Barwick (2013), in their study of 333 children age birth to 6 years of age, reported that 38% of parents of children birth to 18 months, 43% of parents of children 19-36 months, and 29% of parents of children 3 to 6 years of age reported hearing aid use less than all waking hours. Overall, fewer than 50% of children between the ages of birth to 6 years of age wore their hearing aids consistently. Likewise, Moeller, Hoover, Peterson, & Stelmachowicz (2009) in a prospective, longitudinal study that included 7 families of infants with hearing loss showed that only three families achieved full-time technology use by 16.5 months of age and were able to maintain consistent use.

Factors that influence hearing aid use patterns in pediatric patients

The research suggests a variety of reasons for non-use of hearing technology, and these reasons change with age. Moeller et al. (2009) found that toddlers were most likely to take off their hearing aids in the car, when playing outdoors, and when not closely supervised by care providers. With close supervision, consistent use (between “frequently” and “always”) was reported by 16.5 months of age for 6 out of 7 families who participated in the study. In preschool and younger school age children (kindergarten through second grade), Walker, et al. (2013) showed that longer hearing aid use time was associated with age (preschoolers

averaged 8.24 hours/day of hearing aid use, while 5- to 7-year-olds averaged 11.68 hours of hearing aid use per day); hearing levels (children with pure tone averages higher than 50 dB HL wore their technology for an average of 11.12 hours per day); and higher socioeconomic status (children with college educated mothers wore their technology 11.28 hours per day on average). Parents in this study reported that challenges in enforcing consistent hearing aid use in the infancy period were typically related to child state (e.g., temper tantrums, illness, fatigue). Some studies have shown better compliance at school versus at home (Fitzpatrick, et al., 2010).

As children move through school, social concerns have increasing influence on hearing technology use patterns (Elkayam and English, 2003; Keilmann, Limberger and Mann, 2007). A survey by Oticon (Gordey, 2016) of 94 pediatric audiologists and a teen focus group revealed that 85% of audiologists felt it was challenging to get teens to wear their hearing aid consistently; and 63% of audiologists said that finding a hearing aid that was cosmetically appealing was a challenge. When teens talked to audiologists, the teens’ biggest complaints were the size of the hearing device (69%), and the performance of the hearing device (60%). Of high importance to teens in this study were cosmetics and connectivity to other devices. Students also resist wearing classroom assistive technology at high rates due to social pressure. Franks (2008) reported that 53% of students ages 8-18 years who rejected an FM/DM system in the classroom did so due to social reasons.

Hearing aid rejection may also be due to device function problems, as there is a high rate of hearing aid malfunction for school-age children (Diefendorf and Arthur, 1987; Elfenbein, et al., 1988; Elfenbein, 1994; Lipscomb, Von Almen, and Blair, 1992; Blair and Langan, 2000; Most, 2002), or to the perception that hearing aids are not helpful (Franks, 2008).

Finally, hearing levels and language ability appear to influence compliance with technology use. Children with normal hearing in one ear, or less severe hearing loss, have been shown to be more likely to reject their amplification at some point (Fitzpatrick, et al., 2010; Walker, et al., 2013; Munoz, et al., 2014; Gustafson, et al., 2015; Gustafson, et al., 2017). And children with poorer vocabulary were more likely to use hearing aids consistently than children with better vocabulary (Gustafson, et al., 2017).

Pediatric fitting practices and parent education practices vary, even among seasoned pediatric audiologists, which may account for some of the variability in use patterns. Walker, Spratford, Ambrose, Holte, and Oleson (2017) in a study of 113 children with mild hearing loss reported that, while 94% of children were fit with amplification, they were fit significantly later than children with moderate-to-severe hearing loss. Later fitting may result in some resistance by children who perceived they were hearing fine without technology. Meibos, et al. (2016) surveyed 349 pediatric audiologists about how they support parent learning in achieving consistent hearing aid usage for their preschool age children. They found that 90% of pediatric audiologists used data logging to monitor hours of use. Information *not* routinely

provided to parents by audiologists included: how to access loaner hearing aids; available hearing aid accessories; available financial assistance; how to teach hearing aid management to other care providers; how to do hearing aid maintenance; and how to do a Ling 6-sound check. The majority of audiologists in this study reported a desire for more training in counseling skills to support parents with hearing aid management. Munoz, Preston, and Hicken (2014) conducted an exploratory study to examine hearing aid use time for 29 children between 6 months and 7 years of age, and to examine whether providing parents with hearing aid data logging information increased hearing aid use over time. Parents reported challenges with hearing aid retention, and lack of awareness about benefits of amplification. Parents also questioned whether or not hearing aids were effective. Collectively, these studies suggest a need for better support for parents in optimizing hearing aid maintenance and use.

The importance of classroom HAT

In addition to consistent hearing aid use, consistent use of functioning classroom hearing assistive technology is important for auditory language and academic access at school. It is well documented in the literature that children who are DHH demonstrate diminished speech recognition in background noise compared to their typically hearing peers as the signal-to-noise (S/N) ratio decreases (Finitzo-Hieber & Tillman, 1978; Shield & Dockrell, 2003; Jamieson, Kranjc, Yu, & Hodgetts, 2004; Blandy & Lutman, 2005; Sheild & Dockrell, 2008; Iglehart, 2009). Title II of the Americans with Disabilities Act requires schools to ensure that communication for students who are deaf or hard of hearing be as effective as communication for typical students (ADA Title II 28 C.F.R. 35.160(a)(1)). For a student who is DHH to have comparable access to teacher instruction as typically hearing peers, he or she would need to demonstrate speech recognition scores across listening conditions in the 90-95% range (Anderson, 2017). Despite this, mainstream unoccupied classroom noise levels often exceed those recommended by the American National Standards Institute and the Acoustical Society of America (ANSI, 2002; ANSI/ASA, 2010) for optimal speech recognition for young children with typical hearing and those with hearing loss (ASA, 2000; Crandell & Smaldino, 2000; Knecht, Nelson, Whitelaw & Feth, 2002; Nelson, Soli, & Seltz, 2003). For this reason, consistent FM/DM use during the school day is critical for children who are DHH.

PURPOSE

While there is ample research examining hearing aid use patterns during the preschool years, the authors found only one study that examined hearing aid use patterns at school over a wide age/grade range (most studies include children in elementary school, but not in high school). In addition, in only one other study did researchers ask school personnel about their observations of children's hearing technology (personal hearing aids and FM/DM) use and non-use (Gustafson, et al., 2017); that study included 13 families and 10 teachers.

The specific goals of this paper were to describe technology use and non-use rates in a large group of children across a wide age range (preschool through 11th grade), and to explore reasons why personal hearing aids and classroom HAT were discontinued in preschool and school age children with hearing loss. This was accomplished through directly surveying specialists (teachers of the deaf, educational audiologists, speech-language pathologists and other professionals) regarding their caseload and experiences with rejection of hearing technology. This was a novel approach, as most studies to date have solicited information about classroom technology use from audiologists and/or parents, rather than the teachers who directly manage these children. Parent counseling and teacher coaching approaches may be informed and influenced by this knowledge. In addition, school administrators and professionals are responsible for overseeing and implementing IEPs and 504 accommodations for children who are deaf or hard of hearing. Information about time frame for resistance to technology and reasons for resistance to technology may be useful in developing and providing appropriate and mandated services for children who are DHH.

METHODS

This study used a cross-sectional survey design. Teachers of the deaf, educational audiologists, and speech-language pathologists who serve children who are DHH were invited via a website (*Supporting Success for Children with Hearing Loss*) to participate in an online survey about their caseloads for either the 2015-2016 or the 2016-2017 academic year. Information about the survey was shared, and participation encouraged, in the Supporting Success Newsletter, distributed to over 10,000 teachers of the deaf, audiologists, and speech-language pathologists from August 2016 through April 2017. Surveys were completed anonymously.

Participants

Teachers of the deaf, educational audiologists, speech language pathologists, and other professionals responsible for case management of children who were DHH in the public schools completed this survey. There were no other exclusionary criteria. Respondents only reported about children on their caseload that entered school with technology. Respondents only reported about children who wore a hearing aid on one or both ears. Children with cochlear implants were not represented in this study.

Instrument

The questionnaire (Appendix A) was developed by Karen Anderson, and included 10 broad questions, each with specific sub-questions about caseload characteristics (total number of students who used hearing aids and/or FM/DM); characteristics of students who refused to wear hearing aids and classroom assistive technology; use and non-use patterns; use and non-use reasons; and loaner technology availability. Reasons for technology rejection were chosen based on research suggesting that teenagers tend to reject hearing aids for social and/or cosmetic reasons (Elkayam and English, 2003; Franks, 2008; Gordy, 2016; Keilmann et al,

2007), parents may not fully understand the importance of full-time hearing technology use (Marnane and Ching, 2015), that there is a relatively high malfunction rate for hearing technology worn at school (Diefendorf and Arthur, 1987; Elfenbein, et al., 1988; Lipscomb et al, 1992; Elfenbein, 1994; Blair and Langan, 2000; Most, 2002), limited understanding of the benefits of amplification for children with mild and unilateral hearing loss (McKay, Gravel and Tharpe, 2008), and perceived lack of hearing aid benefit (Franks, 2008). Communication mode was not reported for purposes of this study.

Participants were asked to report about hearing aid and classroom FM/DM non-use across professionally established hearing loss categories to facilitate survey completion (e.g. standard audiologic categories were used to designate hearing levels rather than ranges of audiologic categories so that the survey would be as easy for participants to complete as possible, and so survey responses would not be biased by idiosyncratic understanding of hearing loss categories).

Teachers did not report on DHH students on their caseloads who did not wear technology at all (neither hearing aids nor an FM/DM).

Data Analysis

The data were entered into SPSS by the second author and descriptive information was analyzed. Due to the nature of the data (teachers described the characteristics of their student caseload generally and did not provided characteristics for individual students) correlational and/or regression analyses that included demographic information and other predictive factors could not be completed. Only mode scores for each question on the survey could be reported.

RESULTS

Eighty-six surveys were received from DHH teachers, educational audiologists and other professionals. Sixty-six itinerant teachers of the DHH, nine center-based teachers of the DHH, eight educational audiologists, one speech-language pathologist, one interpreter, and one DHH coordinator completed the survey. A total of 1863 students, pre-K through 11th grade were represented in the surveys returned.

Demographics of the respondents, including caseloads, are described in Table 1.

Table 1. Demographic Characteristics of Survey Respondents

Participants (N=86) Students (N=1863)	n	%	Caseload		
			M	range	median
Itinerant teacher of the Deaf	66	77			
Total caseload	1235	66	18.16	7-51	16.5
Center-based/resource room teacher	9	11			
Total caseload	102	5	11.33	4-32	8
Educational Audiologist	8	9			
Total caseload	458	25	52.75	10-150	49
Speech-Language Pathologist	1	1			
Total caseload	30	1.6			
DHH Coordinator submitting for group	1	1			
Total caseload	25	1.6			
Interpreter	1	1			
Total caseload	1				

Hearing Aid and Classroom Hearing Assistive Technology Use

Of the total caseload of 1863 students, hearing aid use was reported for 1848 students (99%). The remaining 15 students wore a different type of technology (for example, FM/DM as their primary amplification). Teachers did *not* report the total number of children on their caseloads with bilateral as opposed to unilateral hearing loss; however, they *did* report on the number of children in each hearing loss category who rejected their technology (for example, “of the non-users on your caseload, how many have unilateral loss with mild to moderate loss in the poor hearing ear?”). Professionals reported that 52% of students with bilateral hearing loss on their caseload wore both of their hearing aids full-time (missed none, or just an occasional school day, i.e., 3 times over the entire school year); 25.2% of students wore both hearing aids 3-4 times per week; 5.4% wore both hearing aids 1-2 times per week; 12% of students refused to wear their hearing aids at all; and 5.2% refused to wear one of their two hearing aids (See Figure 1).

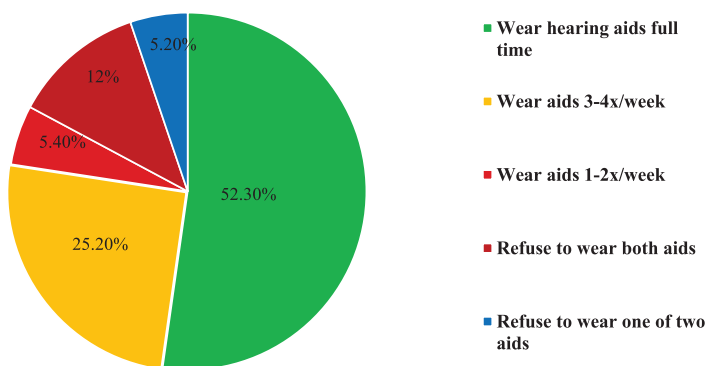


Figure 1. Hearing aid use (reported for 1848 students)

Of the total caseload (1863 students), FM/DM use patterns were reported for 1692 students (91%). Information about FM/DM use was left blank for the remaining 171 students. Participants responded that 534 out of 1692 students (31.6%) did *not* have FM/DM recommended for their use at all; 40% of students used FM/DM routinely (missed none or just an occasional school day); 7% used it only for certain classrooms; 9.2% used it only 1-2 times per week; and 12.3% refused to use FM/DM at all (see Figure 2).

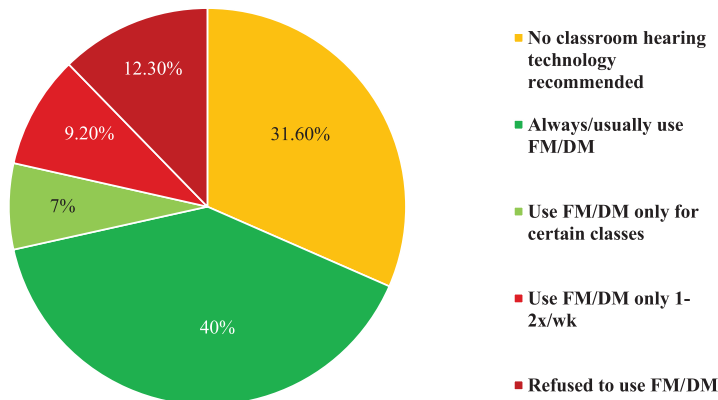


Figure 2. FM/DM Use (reported for 1692 students)

Hearing characteristics of students who refused to use personal amplification or FM/DM

Participants were asked about hearing loss characteristics of the students on their caseload who refused to wear hearing aids, or who only wore them occasionally. This comprised 624 students out of 1692 (36.8%). Of those 624 “non-users”, hearing loss information was provided for 583 (93%). Participants reported that 17% of students who rejected their hearing aids had mild to moderate unilateral hearing loss, and 12% had severe to profound unilateral hearing loss. Of the children with bilateral hearing loss who were deemed non-users (416 students), hearing loss information was supplied for 405 (97%). Of this group, 16% had mild hearing loss, 20% had moderate hearing loss, and 15% had moderately-severe hearing loss in one or both ears. Teachers reported that 26% of non-users with bilateral hearing loss had a severe or profound hearing loss (see Figure 3).

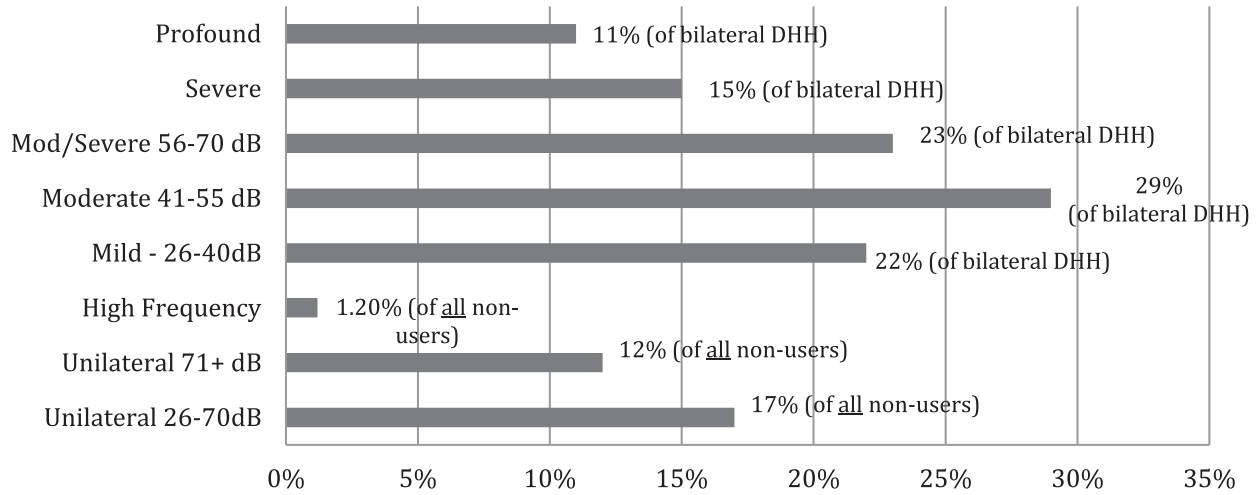


Figure 3. Degree of Hearing Loss for Hearing Aid Non-Users (405 students with bilateral loss and 178 students with unilateral or high frequency loss)

Participants were asked about hearing loss characteristics of the students on their caseloads who refused to use DM/FM in the classroom, or who only used it occasionally. Participants reported that 363 students out of 1158 (31%) refused to use their recommended FM/DM; out of these 363 students, hearing loss

characteristics were provided for 347 students (96%). Children with unilateral hearing loss of any degree comprised 20% of non-users of FM/DM. Children with bilateral mild to moderate hearing loss comprised 39% of non-users, and children with severe to profound hearing loss comprised 26% of non-users (see Figure 4).

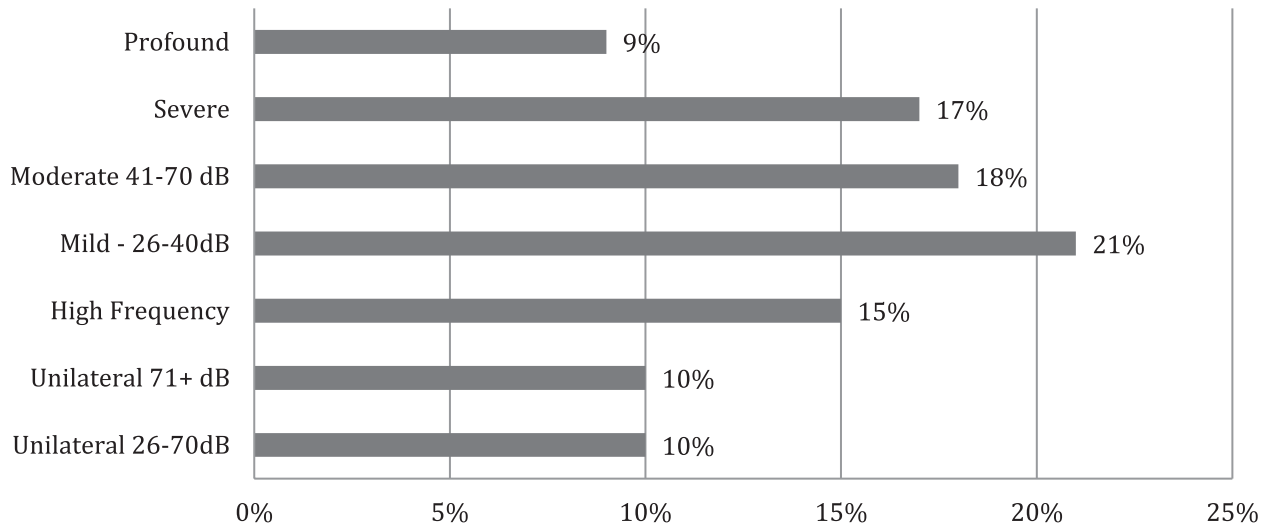


Figure 4. Degree of Hearing Loss for FM/DM non-Users (347 students)

Grade characteristics of students who refused to wear personal amplification or FM/DM

Participants were asked about the time frame (grade) in which students first began to resist using their hearing aids and/or FM/DM. Resisting technology was defined as the transition between using devices regularly to using them for “noticeably less time per week/month”. Modes are reported for those participants who provided grade information. When analyzed based on degree of hearing loss, there was some variability in the grade at which children first began to resist technology. In addition, this question had the lowest response rate among teachers. Information about the grade at which non-use began was provided for only 26% of the 624 children identified as hearing aid non-users (163 students), and 37% of the 363 children identified as FM/DM non-users (135 students). Children with unilateral hearing loss or mild bilateral hearing loss were more likely than children with more severe hearing losses to resist using

their hearing aids in preschool, although non-use for children with mild bilateral hearing loss was common in 2nd, 5th, and 7th grade as well. Children with more severe hearing losses (either unilateral or bilateral) tended to reject technology in later grades. Children with profound unilateral hearing loss or moderate bilateral hearing loss resisted using their hearing aids in 6th grade and their classroom FM/DM between 5th and 6th grade. Children with bilateral moderate to severe hearing loss first began to resist personal hearing aids and classroom FM/DM in 7th grade; for children with severe hearing loss, the mode was 8th grade for resistance to hearing aid use and classroom FM/DM use. Overall, between preschool and 11th grade, the most common time for students to resist wearing their hearing aids was in 6th grade; 28 students resisted wearing their hearing aids beginning in 6th grade, out of a total of 163 for whom a grade was reported (See Figures 5 and 6).

Table 2: Non-use patterns by degree of hearing loss and grade

Degree of Hearing Loss	Initial Resistance to Hearing Aid Use	Number reported out of total number of non-users with this loss	Initial Resistance to FM/DM/HAT Use	Number reported out of total number of non-users with this loss
Mild Unilateral	Preschool	22 of 69 students	6 th grade	15 of 33 students
Severe- Profound Unilateral	6 th grade	13 of 50 students	6 th grade	17 of 36 students
High Frequency	3 rd grade	14 of 59 students	6 th grade	14 of 53 students
Mild	3 rd grade	34 of 91 students	6 th grade	34 of 71 students
Moderate	6 th grade	35 of 119 students		34 of 63 students
Moderate- Severe	7 th grade	24 of 92 students	6-7 th grade	25 students (no total for this degree HL)
Severe	8 th	14 of 59 students	8 th grade	14 of 51 students
Profound	5-6 th grade	7 of 44 students	6 th grade	16 of 32 students

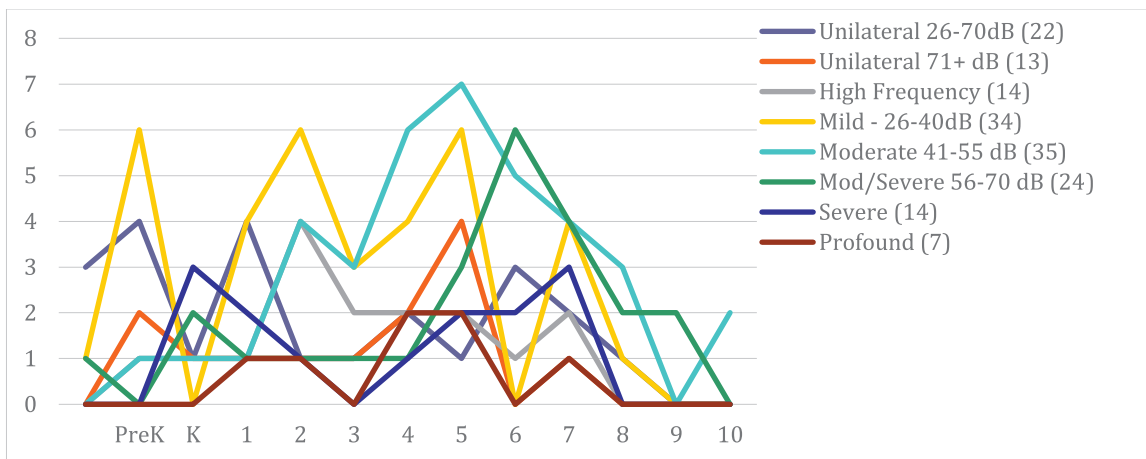


Figure 5. Grade When Resistance to Hearing Aid Use Began by Degree of Loss (number of students).

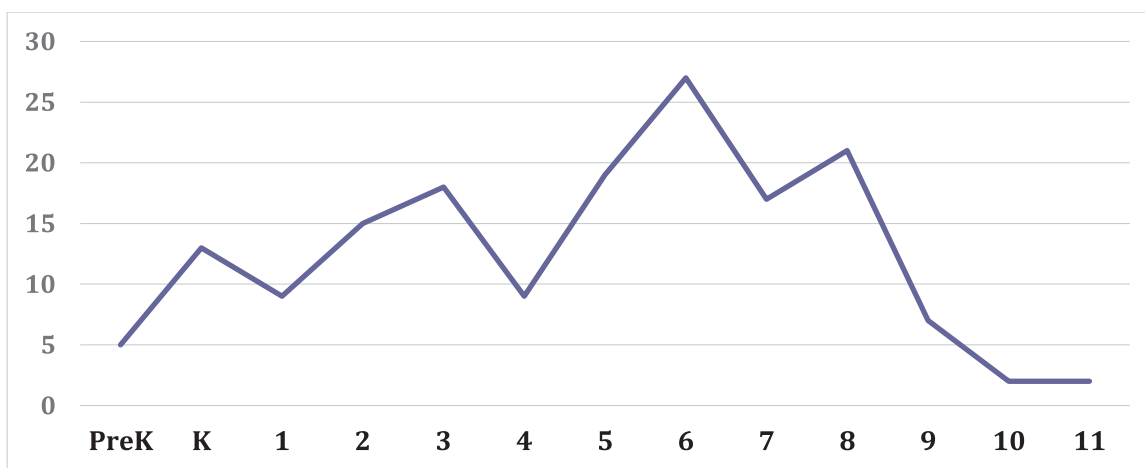


Figure 6. Grade when Resistance to Hearing Aid Use Began, Averaged Across Degree of Hearing Loss for 163 Students

Reasons for resistance to wearing personal amplification and FM/DM

Participants were asked why students began to resist wearing hearing aids based on six categories and across types and degrees of hearing loss. Options were (1) malfunction/repair issues, (2) comfort complaints, (3) family pressures, (4) social pressures, (5) low functioning (lack of perceived benefit or wear was not made a priority in the school setting), and (6) other. Out of a total of 624 students who resisted wearing their hearing aids at some point during school, a reason was provided for 161 students (26%). Participants reported that children in all categories of type and degree of hearing loss most often stopped wearing their hearing aids due to social pressures. Almost half of the students for whom a reason was reported (46.5%) cited social concerns/pressure as the reason for resisting or discontinuing hearing aid use at school.

Out of a total of 363 students who resisted wearing their classroom FM/DM at some point, a reason was provided for 180 students (50%). Participants reported that children in all categories of type and degree of hearing loss most often stopped wearing their hearing aids due to social pressures.

Participants were asked about only the students on their caseload that resisted wearing their hearing aid and/or classroom FM/DM for social reasons. Specifically, participants were asked how many of the students who infrequently used their technology were the only child in a school with hearing technology; how many were the only child in a school with hearing technology but come in contact with other students using hearing devices; how many students have at least one or two other students at school that they see during the week who use hearing technology; how many are in a group of 4 or more students at school that they see every school day but are primarily in mainstream classes; and how many are in a group of 4 or more students that they see every school day and may spend some of the time in mainstream classes (students who spend as much time with hearing children as with children wearing hearing technology). Participants reported on 439 students who stopped wearing their hearing aids for social reasons. Of those students, close to half (49%) were the only student in a school with hearing technology, whereas only 8% of non-users were in a cluster program in which they had regular contact with other students who were DHH.

DISCUSSION

Consistent hearing aid use, often defined by pediatric audiologists as “during all waking hours”, is important for spoken language development. Schools need to be aware of risk factors for technology non-use in order to ensure that IEP and 504 accommodations are implemented and enforced consistently throughout a child’s education, per IDEA, the ADA, and the Rehabilitation Act of 1973. The goal of this study was to describe use patterns and reasons for non-use of personal and classroom HAT for DHH children in school across a wide grade range. This study was unique in that it solicited feedback from a large number of school professionals who work with children who are DHH. Findings from this study were consistent with previous hearing aid data logging and parent report research showing a high technology non-use rate

among school-age children who are DHH, particularly students with less severe degrees of hearing loss, and students with unilateral hearing loss. Similar to other research, participants reported that social factors influenced hearing aid and FM/DM use and non-use.

Hearing aid non-use patterns

Findings regarding hearing aid non-use suggest that almost half of students (47.7%) with any type or degree of hearing loss were not using their hearing aids full time at school as reported by a professional involved in case management. Of the students who refused to wear hearing aids at all, or who wore their hearing aids only 1-2 times per week, approximately one third were students with unilateral hearing loss. Students with bilateral hearing loss who resisted technology use were more likely to have hearing loss in the mild to moderate hearing loss range. These findings are consistent with previous research showing that children with normal hearing in one ear, or less severe hearing loss, were more likely to reject their amplification at some point (Fitzpatrick, et al., 2010; Walker, et al., 2013; Munoz, et al., 2014; Gustafson, et al., 2015). It was a surprise to see a high percentage of children with moderately severe hearing loss (41-70 dB HL) in the non-user category. It seems unlikely that such children could “pass” as hearing in a noisy school setting and it is concerning as it is well documented that children with moderately severe hearing loss are at high risk for language delays (Tomblin, et al., 2015). Preferred language was not reported as part of this survey. It is possible that children with hearing losses in the moderate to severe range were not benefitting as much from hearing aids and were more reliant on a visual communication system, such as Signed Exact English; or a visual language, such as American Sign Language.

For children with unilateral hearing loss, the most commonly reported grade for rejection of hearing aids was 5th grade, although resistance also peaked in preschool and 1st grade. Children with better hearing in the affected ear were more likely to become non-users of their technology, possibly because it is easier for those children to “get by” with the residual hearing they have; they have one normal ear, and enough hearing in their affected ear to be able to localize. For children with severe to profound unilateral hearing loss, poor family support was reported as the primary reason for non-use. It could be that parents (and/or children) did not feel that using a hearing aid in a severely to profoundly impaired ear was worth the effort, given the limited acoustic benefit.

For children with bilateral hearing loss, non-use was reported to occur most often in kindergarten, 3rd grade, 6th grade and 8th grade, with 6th grade being the most common grade overall for non-use. The peak in hearing aid non-use in kindergarten echoes findings of previous research showing that 5 to 6 year-old children were reported by parents to use their hearing aids less than full-time (Munoz, et al., 2013). This study also found that children entering middle school were likely to reject hearing technology, similar to research by Gustafson, et al. (2015) who found that children in grades 5-7 were less likely to wear their technology at school.

Unfortunately, the response rate for questions regarding grade at first resistance to hearing technology use was particularly low

(only 26% for hearing aid non-use and 37% for FM/DM non-use), especially given that the overall response rate for his survey was quite high. In addition, very few teachers reported any information about high school age students; out of 135 students who rejected their hearing aids, 11 (8%) were reported to be in high school. Of interest, *all* 11 high school students who rejected technology were classified as hard of hearing (hearing loss in the mild, moderate, or moderately-severe range). It is possible that teachers did not feel that this question was particularly valuable or important; that they were unsure or had not kept track of the grade at which many of their students *first began* to reject their technology; that they simply could not remember the grades at which students first began to reject their technology; or (especially in the upper grades) that teachers had less regular contact with the students on their caseload. It would be challenging to document—or perhaps even *notice*—the initial stages of technology rejection; yet staying alert to the first signs of resistance is important in appropriate management of students who rely on such technology for educational access. Future research should focus on technology non-use in older children in particular, as this remains an underrepresented and less well understood group in the literature. In addition, it is important to develop a better understanding of students who are DHH as they move from high school to the job force or higher education—when individuals become responsible for their own technology and educational or vocational supports.

Different factors likely account for hearing aid non-use among younger children compared to teenagers. Kindergarten is the first time that children are away from care providers for a significant portion of their day; children who resist amplification in pre-kindergarten and kindergarten may do so because they were inconsistent users or not encouraged to use their hearing aids at home. In previous research, parents of younger children reported a need for more education and support from pediatric audiologists on the benefits of technology as well as strategies for hearing aid retention, especially for children with unilateral or mild losses (Moeller et al., 2009; Moeller, 2011; Munoz, et al., 2016). It could be that parental lack of understanding or difficulty getting toddlers to wear technology (Walker, et al., 2013) leads to inconsistent amplification usage in preschool age children; this survey did not query as to reasons for technology non-use by grade, so this remains speculative. Future research should seek to determine the relationships among early parent education, patterns of hearing aid use in the birth-to-three period, and consistency of hearing aid use in preschool and kindergarten.

As children move through school, peer approval becomes increasingly important. It may be helpful for students who are DHH to receive instruction and practice in how to talk about their hearing loss with peers and self-advocate; future research should aim to determine the benefits of such a practice. Teachers can discuss hearing loss with the class and practice strategies for being a good communicator. Perhaps it could be beneficial to provide opportunities for younger children who are deaf or hard of hearing to interact with other, including older, children who are deaf or hard of hearing. This might facilitate younger children developing a healthy identity and in feeling less stigmatized by their hearing

loss. In addition, older children may be able to model pro-social, disclosure, and self-advocacy strategies for younger children.

Resistance to hearing aids peaks in early middle school when students are often mixed into a larger population, move between classes, and may become more sensitive to being different and fitting in. Prior to entering high school, hearing aid rejection peaks again. Teenagers may feel that hearing loss makes them stand out from their peers. All respondents in the current study reported social pressures as the main reason for technology non-use in the classroom, regardless of age. However, teenagers were particularly sensitive to social pressures, consistent with previous research on this population.

Based on this study, although non-use peaked in kindergarten and grade 3, 6th grade was when the greatest percentage of students began to reject personal hearing technology. It is important, then, to include explicit goals for consistent hearing aid use on a child's IEP or 504 Plan to achieve full time use during the early elementary years.

Classroom FM/DM non-use patterns

Participants reported that 1/3 of DHH students grades pre-K through 11th grade did not have classroom FM/DM recommended for their use. This survey did not provide information about who was responsible for fitting FM/DM, or why FM/DM was not recommended; there is no way to know from these data if these students were not candidates audiologically, if FM/DM was deemed educationally unnecessary, or if students expressed resistance or reluctance to FM/DM during the evaluation process. It is plausible that participants did not know if FM/DM had ever been recommended by a child's audiologist. It is also possible that children who use ASL to communicate would not be good candidates for FM/DM as spoken English used by classroom teachers could interfere with visual language used by a classroom interpreter. This is an area that has not been addressed in the literature, but would be useful in informing educational audiology practice. Of the students who *did* have classroom FM/DM recommended (and presumably included on their IEPs/504 plans), one third of those students did not use their FM/DM consistently. As communication mode/language of the children in this study was not reported, it is not possible to tease out these variables in this data set. This would be an important topic for future study.

Twenty percent of students who refused classroom FM/DM were students with unilateral hearing loss. This is especially troubling as these children are highly adversely affected by background noise in the classroom (Bess & Tharpe, 1984; Bess, Tharpe, & Gibler, 1986) and are at increased risk for language and academic delays (Lieu, 2004).

Children with mild, moderate, and severe losses made up an additional 55% of children who refused to use classroom FM/DM, with children in the mild range comprising 21% of non-users of classroom FM/DM. It is well understood that poor SNR (such as those found in typical classrooms) have a detrimental effect on speech perception for all children, but especially for children with permanent hearing loss (Shield & Dockrell, 2003; Jamieson

et al. 2004; Blandy & Lutman, 2005). Research has also shown that “listening effort” increases at poor SNRs, and secondary task performance (note taking, for example) decreases (Howard, Munro & Plack, 2010).

Again, the most common reason cited for non-use of classroom FM/DM across grades was social pressure, and classroom FM/DM non-use peaked as children approached middle school (6th grade) and high school (9th grade). Educational audiologists and teachers of the deaf should consider strategies for increasing acceptance of and confidence about classroom FM/DM as children move through school, and work to establish these prior to students approaching their teens. Based on the participants in this study, one strategy to facilitate technology compliance might be contact with a peer group of students who are DHH. Nearly half of the non-users in this study were the “one and only” student with a hearing loss in their school. By contrast, only 8% of non-users came from programs where they interacted with other DHH students regularly. It is possible that students who had more contact with peers who were DHH were also students with more severe hearing losses (perhaps they were in self-contained, specialized classrooms for the DHH; perhaps they were receiving more pull-out services in groups with other DHH children), and were therefore more likely to wear their hearing aids more consistently. Nonetheless, this relationship is worth investigating further as, in this group of students, a very low percentage of DHH children who had regular peer contact resisted hearing technology use.

CONCLUSION

School plays an important role in ensuring that children with any type and degree of hearing loss use their personal hearing devices as well as classroom hearing assistive technologies consistently. Consistent hearing aid use in school can go a long way in optimizing communication and lifelong learning potential for all individuals with hearing loss. Results of this study suggest a need for better supports for children from preschool all the way through high school, with skills and attitudes in place prior to children approaching middle school as children appear to be at the highest risk for non-use of both personal and classroom hearing technology in 6th grade. Pediatric audiologists can assist schools by educating families early on about the importance of full time technology use in all settings, supporting families in enforcing consistent hearing aid use, and connecting families to other families who have children who use hearing aids to encourage communication with peers who are DHH. Educational audiologist, teachers of the deaf, and classroom teachers can collaborate in supporting children as they move through various stages of communication and social development; teachers might consider providing direct instruction in skills aimed at increasing self-confidence, resilience to peer pressure, and feelings of fitting in. Overall, results of this study suggest that interacting with other children who have hearing loss and use hearing technology may afford some protection against resistance to using technology. Schools should consider providing opportunities for children who are deaf or hard of hearing to interact regularly with peers who have hearing loss. This may reduce the

stigma associated with using visible, wearable technology (both personal technology and classroom HAT), although more research is needed in this area.

REFERENCES

- Americans With Disabilities Act of 1990, Pub. L. No. 101-336, 104 Stat. 328 (1990).
- Anderson, K. (2017). Estimating the level of communication effectiveness/access. Retrieved from <http://successforkidswithhearingloss.com/wp-content/uploads/2011/08/Estimating-Access-of-Communication-Effectiveness.pdf>.
- Acoustical Society of America (2000). *Classroom acoustics: A resource for creating learning environments with desirable listening conditions*. Available at <http://asa.aip.org/classroom/booklet.html>.
- American National Standards Institute (2002). S12.60–2002, *Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools*. Melville, NY: Author.
- American National Standards Institute/Acoustical Society of America (2010). S12.60.2010/Part 1. *Acoustical performance criteria, design requirements, and guidelines for schools, Part 1: Permanent schools*. New York, NY: Author.
- Bess, F. H., & Tharpe, A. M. (1984). Unilateral hearing impairment in children. *Pediatrics*, 74(2), 206-216.
- 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.
- Blair, J.C., Langan, L. (2000). “Can you hear me?” A longitudinal study of hearing aid monitoring in the classroom. *Journal of Educational Audiology*, volume 8, 34-36.
- Blandy, S., & Lutman, M. (2005). Hearing threshold levels and speech recognition in noise in 7-year-olds. *International Journal Of Audiology*, 44(8), 435-443. doi:10.1080/14992020500189203.
- Ching, T. Y., Dillion, H., Marnane, V. Hou, S. Day, J., Secto, M., . . . Yeh, A. (2013). Outcomes of early- and late- identified children at 3 years of age: findings from a prospective population-based study. *Ear and Hearing*, 34(5), 535-52. Doi: 10.1097/AUD.0b013e3182857718.
- Crandell, C. C., & Smaldino, J. J. (2000). Classroom Acoustics for Children With Normal Hearing and With Hearing Impairment. *Language, Speech & Hearing Services In Schools*, 31(4), 362-370.
- Diefendorf, A., & Arthur, D. (1987). Monitoring children’s hearing aids: Re-examining the problem. *The Volta Review*, 90, 17-26.
- Doković, S., Gligorović, M., Ostojić, S., Dimić, N., Radić-Šestić, M., Slavnić, S. (2014). Can Mild Bilateral Sensorineural Hearing Loss Affect Developmental Abilities in Younger School-Age Children? *The Journal of Deaf Studies and Deaf Education*, 19(4), 484-495. <https://doi.org/10.1093/deafed/enu018>.

- Elfenbein, J., Bentler, R., Davis, J., & Niebuhr, D. (1988). Status of school children's hearing aids relative to monitoring practices. *Ear and Hearing, 9*(4), 212-217.
- Elfenbein, J. (1994). Monitoring preschoolers' hearing aids: Issues in program design and implementation. *American Journal of Audiology, 3*(2), 65-70.
- Elkayam, J., & English, K. (2003). Counseling adolescents with hearing loss with the use of self-assessment/significant other questionnaires. *Journal of the American Academy of Audiology, 14*(9), 485-499.
- Finitzo-Hieber, T., Tillman, T. M. (1978). Room Acoustics Effects on Monosyllabic Word Discrimination Ability for Normal and Hearing-Impaired Children. *Journal of Speech, Language, and Hearing Research, 21*, 440-458. doi:10.1044/jshr.2103.440
- Fitzpatrick, E. M., Durieux-Smith, A., & Whittingham, J. (2010). Clinical practice for children with mild bilateral and unilateral hearing loss. *Ear And Hearing, 31*(3), 392-400. doi:10.1097/AUD.0b013e3181c5b2b9.
- Franks, J.L. (2008). "Why Do Students with Hearing Impairment Resist Wearing FM Amplification?" Master's Theses and Doctoral Dissertations. Paper 205. Retrieved from http://successforkidswithhearingloss.com/wp-content/uploads/2014/06/FM_Acceptance-Franks-article.pdf.
- Gordey, D. (2016). Hearing aid selection and teens: Perspectives from hearing care professionals. Retrieved from <http://www.edaud.org/handouts/EW-2.pdf>.
- Gustafson, S. S., Davis, H., Hornsby, B. Y., & Bess, F. H. (2015). Factors Influencing Hearing Aid Use in the Classroom: A Pilot Study. *American Journal Of Audiology, 24*(4), 563-568. doi:10.1044/2015_AJA-15-0024.
- Gustafson, S.S., Ricketts, T. & Tharpe, A.M. (2017). Hearing Technology Use and Management in School-Age Children: Reports from Data Logs, Parents, and Teachers. *Journal of American Academy of Audiology, 28*(10), 883-892. doi: 10.3766/jaaa.16042.
- Howard, C. S., Munro, K. J., & Plack, C. J. (2010). Listening effort at signal-to-noise ratios that are typical of the school classroom. *International Journal Of Audiology, 49*(12), 928-932. doi:10.3109/14992027.2010.520036.
- Individuals with Disabilities Education Act, 20 U.S.C. § 1400 (2004).
- Iglehart, F. (2009). *Combined effects of classroom reverberation and noise on speech perception by students with typical and impaired hearing*. Paper presented at Inter-Noise 2009, Ottawa, Ontario, Canada.
- Jamieson, D., Kranjc, G., Yu, K., & Hodgetts, W. (2004). Speech intelligibility of young school-aged children in the presence of real-life classroom noise. *Journal Of The American Academy Of Audiology, 15*(7), 508-517.
- Joint Committee on Infant Hearing. (2007). Year 2007 position statement: Principles and guidelines for early hearing detection and intervention programs. *Pediatrics, 120*, 898-921.
- Keilmann, A., Limberger, A., & Mann, W.J. (2007). Psychological and physical well-being in hearing-impaired children. *International Journal of Pediatric Otorhinolaryngology, 71*, 1747-1742. <https://doi.org/10.1016/j.ijporl.2007.07.013>
- Knecht, H. A., Nelson, P. B., Whitelaw, G. M., & Feth, L. L. (2002). Background noise levels and reverberation times in unoccupied classrooms: predictions and measurements. *American Journal Of Audiology, 11*(2), 65.
- Koehlinger, K. M., Van Horne, A. 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*(5), 1701-1714. DOI:10.1044/1092-4388(2013/12-0188).
- Lieu, J. C. (2004). Speech-language and educational consequences of unilateral hearing loss in children. *Archives Of Otolaryngology-Head & Neck Surgery, 130*(5), 524-530.
- Lipscomb, M., Von Almen, P., & Blair, J.C. (1992). Students as active participants in hearing aid maintenance. *Language Speech and Hearing Services in Schools, 23*(3), 208-213. DOI: 10.1044/0161-1461.2303.208.
- Marnane, V. & Ching, T. (2015). Hearing aid and cochlear implant use in children with hearing loss and three years of age: Predictors of use and predictors of change in use. *International Journal of Audiology, 54*(8), 544-551. DOI: 10.3109/14992027.2015.1017660
- 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. DOI: 10.1177/1084713807313570.
- Meibos, A., Munoz, K., White, K., Preston, E., Pitt, C., & Twohig, M. (2016). Audiologist practices: Parent hearing aid education and support. *Journal Of The American Academy Of Audiology, 27*(4), 324-332. doi:10.3766/jaaa.15007.
- Moeller, M. P. (2000). Early intervention and language development in children who are deaf and hard of hearing. *Pediatrics, 106*(3), E43. doi: 10.1542/peds.106.3.e43.
- Moeller, M.P. (2011). Language development: New insights and persistent puzzles. *Seminars in Hearing 32*(2), 172-181.
- Moeller, M. P., Hoover, B., Peterson, B., & Stelmachowicz, P. (2009). Consistency of hearing aid use in infants with early-identified hearing loss. *American Journal Of Audiology, 18*(1), 14-23. doi:10.1044/1059-0889(2008/08-0010)
- Moeller, M. P., McCleary, E., Putman, C., Tyler-Krings, A., Hoover, B., & Stelmachowicz, P. (2010). Longitudinal Development of Phonology and Morphology in Children with Late-Identified Mild-Moderate Sensorineural Hearing Loss. *Ear and Hearing, 31*(5), 625-635. <http://doi.org/10.1097/AUD.0b013e3181df5cc2>.

- Most, T. (2002). The effectiveness of an intervention program on hearing aid maintenance for teenagers and their teachers. *American Annals of the Deaf*, 147(4), 29-37.
- Muñoz, K., Blaiser, K., & Barwick, K. (2013). Parent hearing aid experiences in the united states. *Journal Of The American Academy Of Audiology*, 24(1), 5-16. doi:10.3766/jaaa.24.1.2.
- Muñoz, K., Hill, M. M. (2015). Hearing aid use for children with hearing loss: A literature review. *Perspectives On Hearing & Hearing Disorders In Childhood*, 25(1), 4-14. doi:10.1044/hhdc25.1.4.
- Muñoz, K., Preston, E., & Hicken, S. (2014). Pediatric hearing aid use: How can audiologists support parents to increase consistency? *Journal of the American Academy of Audiology*, 25(4), 380-387. doi:10.3766/jaaa.25.4.9.
- Muñoz, K., Rusk, S. P., Nelson, L., Preston, E., White, K. R., Barrett, T. S., & Twohig, M. P. (2016). Pediatric hearing aid management: Parent-reported needs for learning support. *Ear And Hearing*, 37(6), 703-709. doi: 10.1097/AUD.0000000000000338.
- Nelson, P.B., Soli, S.D., & Seltz, A. (2003). Classroom acoustics II: Acoustical barriers to learning. Retrieved from <http://asa.aip.org/classroom/bookletII.pdf>.
- Pardeck, J. (2002). A commentary on what social workers need to know about the Individuals with Disability Education Act (IDEA) and the Americans with Disabilities Act (ADA). *Journal Of Social Work In Disability & Rehabilitation*, 1(2), 83-94. doi: 10.1300/J198v01n02_06.
- Shield B., & Dockrell J (2003). The effects of noise on children at school: a review. *Journal of Building Acoustics* 10: 97-106.
- Shield, B., & Dockrell, J. (2008). The effects of environmental and classroom noise on the academic attainments of primary school children. *The Journal of the Acoustical Society of America*, 123, 133-144.
- Sharma, A., Spahr, A., Dorman, M., & Todd, N. W. (2002). Early cochlear implantation in children allows normal development of central auditory pathways. *Annals Of Otology, Rhinology & Laryngology*, 111(38). <https://doi.org/10.1177/00034894021110S508>.
- Sininger, Y. S., Grimes, A., & Christensen, E. (2010). Auditory development in early amplified children: Factors influencing auditory-based communication outcomes in children with hearing loss. *Ear and Hearing*, 31(2), 166-185. doi: 10.1097/AUD.0b013e3181c8e7b6.
- Stiles, D. J., Bentler, R. A., & McGregor, K. K. (2012). The Speech Intelligibility Index and the pure-tone average as predictors of lexical ability in children fit with hearing AIDS. *Journal Of Speech, Language, And Hearing Research*, 55(3), 764-778. doi:10.1044/1092-4388(2011/10-0264).
- Tomblin, J. B., Harrison, M., Ambrose, S. E., Walker, E. A., Oleson, J. J., & Moeller, M. P. (2015). Language outcomes in young children with mild to severe hearing loss. *Ear and Hearing*, 36 Suppl 176S-91S. doi:10.1097/AUD.0000000000000219.
- Tomblin, J. B., Oleson, J. J., Ambrose, S. E., Walker, E., & Moeller, M. P. (2014). The influence of hearing aids on the speech and language development of children with hearing loss. *JAMA Otolaryngology-- Head & Neck Surgery*, 140(5), 403-409. doi:10.1001/jamaoto.2014.267.
- U.S. Department of Justice. (2010) Americans with Disabilities Act Title II Regulations: Non discrimination on the basis of disabilities in state and local government services. Retrieved from https://www.ada.gov/regs2010/titleII_2010/titleII_2010_regulations.htm
- Walker, E. A., Holte, L., McCreery, R. W., Spratford, M., Page, T., & Moeller, M. P. (2015). The influence of hearing aid use on outcomes of children with mild hearing loss. *Journal of Speech, Language and Hearing Research*, 58(5), 1611-1625. doi:10.1044/2015_JSLHR-H-15-0043.
- Walker, E.A., McCreery, R.W., Spratford, M., Oleson, J.J., Van Buren, J., Bentler, R., Roush, P., & Moeller, M.P. (2015). Trends and predictors of longitudinal hearing aids for children who are hard of hearing. *Ear and Hearing*, 36, Suppl 1, 38S-47S. DOI: 10.1097/AUD.0000000000000208
- Walker, E. A., Spratford, M., Ambrose, S. E., Holte, L., & Oleson, J. (2017). Service delivery to children with mild hearing loss: Current practice patterns and parent perceptions. *American Journal Of Audiology*, 26(1), 38-52. doi:10.1044/2016_AJA-16-0063.
- Walker, E. A., Spratford, M., Moeller, M. P., Oleson, J., Ou, H., Roush, P., & Jacobs, S. (2013). Predictors of hearing aid use time in children with mild-severe hearing loss. *Language, Speech, and Hearing Services in Schools*, 44(1), 73-88. doi:10.1044/0161-1461(2012/12-0005).
- Yoshinaga-Itano, C., Sedey, A.L., Coulter, D.K., Mehl, A.L. (1998). Language of early- and later-identified children with hearing loss. *Pediatrics*, 102(5), 1161-1171.

Appendix

Children Rejecting Hearing Devices Survey

Think about your caseload in 2015-2016 or, if you are already familiar, with your 2016-2017 caseload. Please answer the following based on what you know/recall about the students you serve. Best guesstimates are acceptable!

How many students were/are on your caseload?

Of those with bilateral loss with hearing aids recommended for both ears, how many students in your caseload (above) refuse to wear a hearing aid in one ear (wore one hearing aid 3x/month or less and usually wore the other aid)?
Of your caseload total (above), how many refused to use their hearing aids (wore 3x/month or less)?
Of your caseload total, how many occasionally use their hearing aids (1-2x/week)?
Of your caseload total, how many often use their hearing aids (3-4x/week)?
Of your caseload total, how many usually or always use their hearing aids (missed none or just an occasional school day, i.e., 3x per school year)?
Of your caseload total, how many did not have an FM/DM (classroom hearing technology) system recommended for their use?
Of your caseload total, how many refused to use recommended classroom hearing technology (wore 3x/month or less)?
Of your caseload total, how many occasionally use recommended classroom hearing technology (1-2x/week)?
Of your caseload total, if in secondary school, how many use classroom hearing technology only for certain classes (i.e., only English and Social Studies)?
Of your caseload total, how many often use recommended classroom hearing technology (3-4x/week)?
Of your caseload total, how many usually/always use recommended classroom hearing technology (missed none or just an occasional school day, i.e., 3x per school year)?

Think about your students who refuse to use their hearing aids or only use them occasionally (1-2x/week). Of these ‘non-users’ please answer the following about their degree/type of hearing loss to the best of your knowledge/ recollection. Again, your best guesstimates are acceptable.

How many have unilateral loss with mild to moderate loss in the poor hearing ear (26-70 dB)?
How many have unilateral loss with severe to profound loss in the poor hearing ear (71+ dB)?
How many have a high frequency loss (i.e. 'notch' at 3000 Hz - 8000 Hz) only?
Of those with bilateral loss and refuse to wear a hearing aid in one ear, what is the degree of loss in the ear that doesn't use the hearing aid? Please enter two numbers in the following box that represent (1) how many have mild-moderate loss? (2) how many have severe/profound loss? in the non-hearing-aid-use ear?
How many have mild loss (26-40 dB) of any type (sensorineural, mixed, conductive)? If the degree of hearing loss is different in the two ears, the better ear would have a mild loss.
How many have moderate loss (41-55 dB) of any type (sensorineural, mixed, conductive)? If the degree of hearing loss is different in the two ears, the better ear would have a moderate loss.
How many have moderate to severe loss (56-70 dB) of any type (sensorineural, mixed)? If the degree of hearing loss is different in the two ears, the better ear would have a moderate to severe loss.
How many have severe loss (71-90 dB) of any type (sensorineural, mixed)? If the degree of hearing loss is different in the two ears, the better ear would have a severe loss.
How many have profound loss (91+ dB) of any type (sensorineural, mixed, conductive)?

This time think about your students who refuse to use classroom hearing technology or only use it only occasionally (1-2x/week). Of these ‘non-users’ please answer the following about their degree/type of hearing loss to the best of your knowledge/ recollection.

How many have unilateral loss with mild to moderate loss in the poor hearing ear (26-70 dB)?
How many have unilateral loss with severe to profound loss in the poor hearing ear (71+ dB)?
How many have a high frequency loss (i.e. 'notch' at 3000 Hz - 8000 Hz) only?
How many have mild loss (26-40 dB) of any type (sensorineural, mixed, conductive)? If the degree of hearing loss is different in the two ears, the better ear would have a mild loss. 27 27/52 nonusers
How many have moderate loss (41-55 dB) of any type (sensorineural, mixed, conductive)? If the degree of hearing loss is different in the two ears, the better ear would have a moderate loss.
How many have moderate to severe loss (56-70 dB) of any type (sensorineural, mixed)? If the degree of hearing loss is different in the two ears, the better ear would have a moderate to severe loss.
How many have severe loss (71-90 dB) of any type (sensorineural, mixed)? If the degree of hearing loss is different in the two ears, the better ear would have a severe loss.
How many have profound loss (91+ dB) of any type (sensorineural, mixed)?

We now want to know about WHEN your students began to resist using their hearing aid(s). Please answer the following based on what you know/recall about the students you serve(d). Resisting hearing aid use means that they had been usually using their device(s) but then began to use them noticeably less time per week/month. If you have multiple students in any category below, please enter the grades that resistance began. For example, if you had 3 students with mild loss that resisted using their hearing aids you could enter (K, 3, 6) for the three grades during which their pattern of hearing aid use changed.

Unilateral loss with mild to moderate loss in the poor hearing ear (26-70 dB):
High frequency loss (i.e. 'notch' at 3000 Hz - 8000 Hz) only:
Mild loss (26-40 dB) of any type (sensorineural, mixed, conductive) in both ears or the better hearing ear:
Moderate loss (41-55 dB) of any type (sensorineural, mixed, conductive) in both ears or the better hearing ear:
Moderate to severe loss (56-70 dB) of any type (sensorineural, mixed) in both ears or the better hearing ear:
Severe loss (71-90 dB) of any type (sensorineural, mixed) in both ears or the better hearing ear:
Profound loss (91+ dB) of any type (sensorineural, mixed)?

We now want to know about WHY your students began to resist using their hearing aid(s). Please answer the following based on what you know/recall about the students you serve(d). Resisting hearing aid use means that they had been usually using their device(s) but then began to use them noticeably less time per week/month. Please enter numbers indicating the following: (1) malfunction/repair issues, (2) comfort complaints not related to malfunction (i.e., itchy, earmold feels tight...), (3) family pressures, (4) social pressures, (5) low functioning; haven't achieved successful wear as yet, (6) unknown - no good 'guess' about which of the other choices it would be. Example: You have two students with mild to moderate unilateral loss. One stopped using due to repair issues and the other due to social pressures. You would enter 1, 4 into the box.

Unilateral loss with mild to moderate loss in the poor hearing ear (26-70 dB):
Unilateral loss with severe to profound loss in the poor hearing ear (26-70 dB):
High frequency loss (i.e. 'notch' at 3000 Hz - 8000 Hz) only:
Mild loss (26-40 dB) of any type (sensorineural, mixed, conductive) in both ears or the better hearing ear:
Moderate loss (41-55 dB) of any type (sensorineural, mixed, conductive) in both ears or the better hearing ear:
Moderate to severe loss (56-70 dB) of any type (sensorineural, mixed) in both ears or the better hearing ear:
Severe loss (71-90 dB) of any type (sensorineural, mixed) in both ears or the better hearing ear:
Profound loss (91+ dB) of any type (sensorineural, mixed)?

We now want to know about WHEN your students began to resist using their classroom hearing technology (i.e., FM). Please answer the following based on what you know/recall about the students you serve(d). Resisting classroom hearing technology use means that they had been usually using their device(s) but then began to use them noticeably less time per week/month. If you have multiple students in any category below, please enter the grades that resistance began. For example, if you had 3 students with mild loss that resisted using their FM systems you could enter (K, 3, 6) for the three grades during which their pattern of hearing aid use changed.

Unilateral loss with mild to moderate loss in the poor hearing ear (26-70 dB):
Unilateral loss with severe to profound loss in the poor hearing ear (26-70 dB):
High frequency loss (i.e. 'notch' at 3000 Hz - 8000 Hz) only:
Mild loss (26-40 dB) of any type (sensorineural, mixed, conductive) in both ears or the better hearing ear:
Moderate loss (41-55 dB) of any type (sensorineural, mixed, conductive) in both ears or the better hearing ear:
Moderate to severe loss (56-70 dB) of any type (sensorineural, mixed) in both ears or the better hearing ear:
Severe loss (71-90 dB) of any type (sensorineural, mixed) in both ears or the better hearing ear:
Profound loss (91+ dB) of any type (sensorineural, mixed)?

We now want to know about WHY your students began to resist using their classroom hearing technology. Resisting classroom hearing technology use means that they had been usually using their device(s) but then began to use them noticeably less time per week/month. Please enter numbers: (1) malfunction/repair issues, (2) comfort complaints not related to malfunction (i.e., itchy, sounds funny...), (3) family pressures, (4) social pressures, (5) teacher resistance to using transmitter (appropriately), (6) low functioning; haven't achieved successful wear as yet, (7) unknown - no good 'guess' about which of the other choices it would be. Example: You have three students with moderate unilateral loss. One stopped using due to family pressure, one due to social pressure, and the last had a teacher who 'forgot' to use the transmitter frequently. You would enter 3, 4, 5 into the box.

Unilateral loss with mild to moderate loss in the poor hearing ear (26-70 dB):
Unilateral loss with severe to profound loss in the poor hearing ear (26-70 dB):
High frequency loss (i.e. 'notch' at 3000 Hz - 8000 Hz) only:
Mild loss (26-40 dB) of any type (sensorineural, mixed, conductive) in both ears or the better hearing ear:
Moderate loss (41-55 dB) of any type (sensorineural, mixed, conductive) in both ears or the better hearing ear:
Moderate to severe loss (56-70 dB) of any type (sensorineural, mixed) in both ears or the better hearing ear:
Severe loss (71-90 dB) of any type (sensorineural, mixed) in both ears or the better hearing ear:
Profound loss (91+ dB) of any type (sensorineural, mixed)?

Now think about those students who resist using hearing aids and/or classroom hearing technology due to social reasons. In other words, they were using their devices frequently and then their willingness to use them in school declined. Please enter the number of your students who use their devices 1-2 times per week or less per who interact with other students who have hearing loss as described below. Please select only once choice for each of your non-user students.

<p>How many are 'one and onlies' with no other student in the school using hearing devices OR there may be another student or two with devices but this student does not really come into contact with the others AND it is unlikely that they come into contact with other students using hearing devices (i.e., not at all or no more than once per year)? So, one and only with no real DHH contact.</p>
<p>How many are 'one and onlies' with no other student in the school using hearing devices AND that they DO come into contact with other students using hearing devices (i.e., participates in get arranged together, chat groups, has DHH text friends, etc.)? So, one and only but has some, perhaps regular, DHH contact.</p>
<p>How many have at least one or two others at school that they see during the week (i.e., share SLP time together, in same class, etc.). So, part of a small group of other students with hearing devices that they see often.</p>
<p>How many are in a group of 4 or more students at school that they see every school day but are primarily in mainstream classes? So, part of a group of students with hearing loss that come together daily but spend much of the school day (i.e., 80%) in the mainstream with typically hearing peers.</p>
<p>How many are in a group of 4 or more students (i.e. center-based or cluster program) at school that they see every school day and may spend some of the time (i.e. 40%) in mainstream classes? So, part of a group of students with hearing loss that spend much of the time together daily as less in the mainstream with typically hearing peers.</p>

Are loaner units available if a student experiences malfunction and needs to have the device sent in for repair? Please read all of the choices and choose only those that apply in your situation. You should have a choice for hearing aids and for classroom hearing technology (at least 2 responses).

Yes, a limited number of loaner hearing aids are available from school.
Yes, clinical audiologists in our area that our students often go to have loaner hearing aids available.
Yes, there is one or more clinical audiologists that offer loaner aids, but fewer than half of our students actually go to them or the families resist taking them there, making getting a loaner from the audiologist not a very functional choice for many students.
No, no loaner hearing aids are available from school.
Yes, we have enough 'extra' FMs and components that we can usually get a student 'up and running' within a day or two when their classroom hearing technology malfunctions.
Yes, we have some 'extra' FMs and components but the support services needed to get them to the student are limited, so it can often take a week or more to get the student 'up and running' again while the unit is sent in for repair.
We have some equipment but it is often dated, not the same, and/or inadequately suits the need of the student. So sometimes we can get the student 'up and running' again and other times the student goes without or ends up with loaner equipment that really isn't a good fit for his or her needs.
No, we really do not have loaner classroom hearing technology available for use when a student's unit malfunctions.

Thanks so much for your participation! Now tell us who you are:

Itinerant Teacher of the Deaf/Hard of Hearing
Center-based/resource room Teacher of the Deaf/Hard of Hearing
Educational Audiologist
Speech Language Pathologist working with DHH students
DHH Coordinator submitting group results