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The Seven Habits of Highly Effective Audiologists Who Serve Children

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Introduction

With early identification of hearing loss, many children are benefiting from hearing technology prior to their first birthday. Research has shown that even children with a mild hearing loss or a unilateral hearing loss are at risk for academic failure (Bess, 1985; Bess, Klee, & Culbertson, 1986; Bess & Tharpe, 1988; Tharpe & Bess, 1991, 1999). Consequently, amplification is often recommended to reduce the deleterious effects of hearing loss. The provision of an assistive hearing instrument is one small part of a child's hearing success. The benefit of hearing technology certainly depends on features of the instrument itself, but also is influenced by many interrelated factors that are external to the device. Providing optimal hearing health care for children extends beyond the sophistication of the circuitry worn by the child. Depending on the audiological environment, it may be difficult to address all the hearing health needs of a child due to time constraints. Therefore, a program which addresses seven areas critical to the communication success of children with hearing loss is proposed as shown in Figure 1. The program includes resources for each of the critical areas so that the audiologist may provide optimum hearing health care efficiently and involve the support of a child's caregivers and educational providers.

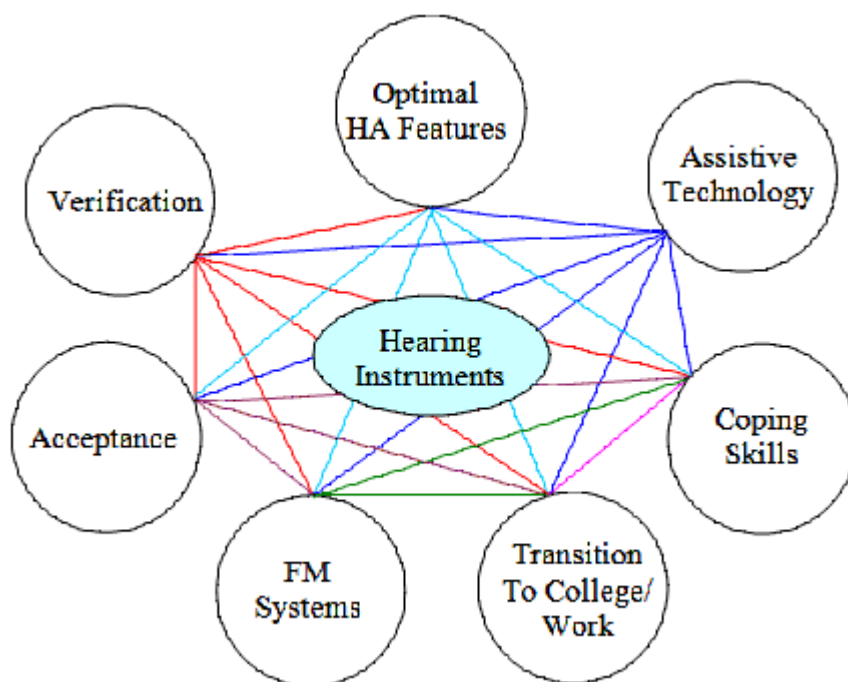


Figure 1. Illustration of the interrelationships among key factors to enhance communication success for children with hearing loss.

The purpose of this review is to provide a framework for comprehensive hearing health care for children and resources that will facilitate service delivery in these areas. Although some audiologists specialize in pediatrics, particular work settings may not be conducive to providing the proposed comprehensive care. Therefore, efforts may be necessary to network with other service providers such as the educational audiologist who maintains FM technology or speech-language pathologists who may provide coping strategies. The audiologist who provides service to children, whether it is diagnostic and/or rehabilitative, must consider how all seven areas are addressed in order to provide optimum health care for each child. These areas, i.e. the seven habits of highly effective audiologists who serve children, include the following:

1. Recommendations for the optimal features on the hearing aid to obtain maximum benefit particularly in noisy educational environments,
2. Verification of the fitting with efficient and reliable procedures to ensure benefit is received,
3. Presentation of the technology in a positive way that encourages acceptance,
4. Accessing and interfacing with FM technology so that learning may occur at optimum signal-to-noise ratios,
5. Provision of information regarding transition to college/work so that access to communication is maintained through accommodations provided through the American with Disabilities Act and tuition programs through various state agencies,
6. Demonstration of coping skills to compensate for limitations of technology, and
7. Integration of assistive technology to function in society safely and independently.

Not all of these areas may be offered in one location through services provided by one audiologist. However, it is incumbent upon the professional who serves children with hearing loss to consider the needs of children in these seven areas and provide recommendations and referrals when necessary so that all seven areas are addressed. Each area will be discussed in greater detail with references to resources that may facilitate service delivery in that area.

Seven Areas to Optimize Communication for Children with Hearing Loss

1. Optimal Features for Pediatric Hearing Aid Fittings

Audiologists who are providing highly effective care for children with hearing loss should consider how certain features on a hearing aid may facilitate communication. Some of the optimal features on current hearing instruments are straightforward. For example, most agree that every child should be fit with an instrument that contains a t-coil because this feature allows access to many assistive devices such as FM systems or neckloops, for cell phones, that may provide significant benefit. With movements such as "Let's Loop America" (see website below) there are more induction loops provided in public places that will provide greater access to communication for those with t-coils.

More information regarding the benefits of induction loops and the need for t-coils in hearing instruments may be found at www.hearingloop.org.

Just as a t-coil feature opens many opportunities for children to access signal through induction loops, all hearing instruments recommended for children should have direct audio input (DAI) capability. This connection is particularly beneficial for accessing a signal from an FM receiver. Due to the small size of children's ears, the use of ear level FM technology, which provides a compact system arrangement, is the ideal FM configuration. Children who have both t-coil and DAI have numerous options for receiving a signal from a remote microphone, which can significantly increase speech recognition (Lewis, Crandell, Valente, & Horn, 2004; Lewis, Valente, Horn, & Crandell, 2005). Regardless of the mode of transmission, induction loop or DAI, children should have access to hearing the signal from the remote (used by the speaker/teacher) microphone while simultaneously hearing signals from the local (hearing aid or environmental) microphone.

A website that provides a summary of most of the BTE instruments and the DAI connections is provided by Phonak at www.phonak.com/professional/products/fm.htm.

Although most agree that features such as locking battery doors and deactivating the volume controls are worthwhile, the inclusion of automatic directional microphone technology has been debated. Some argue that a child

may miss conversations from behind and experience a reduction in incidental learning. However, research has shown directional microphones can significantly improve speech recognition in noise (Lewis et al., 2004), which is particularly useful for children in noisy classrooms. Longitudinal research is needed to provide support for this debate. In the meantime, one might argue that children should benefit from the greatest signal-to-noise ratio consistently throughout the day in order to learn from the primary source of information, the classroom teacher, who is typically talking in the front, rather than compromise this benefit to possibly learn some fraction of the day from a peer or teacher who is talking from behind.

An illustrative software demonstration of the effects of various directional microphone response patterns is provided by Gennum at www.gennum.com/hip/education/index.html

2. Verification of Hearing Instrument Fittings

Pediatric hearing instrument fittings can be very challenging as a child's attention span and tolerance of strangers varies. Therefore, verification via simulations is extremely important. Seewald and colleagues have shown that software predictions can provide reasonable simulations of acoustic levels provided by amplification in small ears (Seewald & Scollie, 2003). All hearing aid test equipment provide programs to predict a target for amplification. These targets are then compared to the output that would be predicted to occur in a child's ear for a particular age and hearing aid style. This can be done in less than five minutes per ear and can provide accurate verification of the hearing instrument fitting, particularly if a child's actual real-ear to coupler difference is measured and included in the programming steps. An innovative method of quickly, easily and accurately measuring RECD has been described by Scollie (2006).

Given the accuracy of these simulations and the sophistication of advanced hearing instrument circuitry, the use of aided thresholds is no longer considered a valid way to verify pediatric hearing aid fittings. Measuring thresholds at stimulus levels of 20 or 30 dB HL would invoke gains that may be entirely different from what the child experiences when listening to conversational speech as digital hearing instruments handle a steady state signal very differently from speech. However, many educational programs need the "aided thresholds" as a routine part of the annual assessment. It is suggested that "predicted" aided thresholds be presented on the audiogram. These can be based on the real ear measurements of insertion gain. For example, if insertion gain at 1 KHz is 40 dB, then the "predicted" aided threshold for a child with hearing loss of 60 dB HL would be 20 dB HL. These "predicted" values can be recorded on the audiogram with an asterisk to indicate that the values are "predicted based on real-ear measures." Using real-ear measures to predict the thresholds would not only save considerable time, but also avoids boredom and non-compliance that is often associated with long sessions of play audiometry.

Following verification of gain settings, time spent measuring speech recognition would be more useful than evaluation of aided thresholds. The speech recognition scores provide evidence that the amplified signal is proceeding through the instrument and actually interpreted by the child. This information can be extremely helpful to the educator in providing accommodations based on performance. It is important that conclusions regarding changes in performance be made with regard to statistical power. Often children are given a 25-word list and a percent correct score is reported. Although the high variability in percent correct scores was pointed out by Thornton and Raffin (1978), clinical decisions are often made without regard for statistical significance. For example, a score of 75% correct speech recognition obtained with new digital hearing instruments might be considered a significant improvement related to a score of 60% obtained with older analog hearing instruments. However, according to tables provided by Thornton and Raffin (1978) such a difference for a 25-word list does not reach statistical significance. Verification of hearing aid performance through the use of percent correct speech recognition measures will only be valid when the statistical variability is included.

The Speech Recognition Interpretation (SPRINT) charts (Thibodeau, 2002) may be used to conveniently compare two

speech recognition scores. Demonstrations and downloadable charts are available at www.utdallas.edu/~thib

3. Hearing Instruments and Acceptance

Perhaps as important as the accurate adjustment of hearing aid acoustic features is the development of a positive paradigm, or view, regarding amplification. With the increase in ear level technology for cell phones, children are seeing more adults wear devices on their ears. The advantage of this is the social acceptance of devices at the ear, much like glasses are accepted for eyes. There are many cosmetic features to consider when selecting glasses compared to the solid colors that are offered for hearing aids. As society starts to wear something at the ear for purposes other than amplification, it might be possible that more cosmetic options would be offered. When this happens, audiologists will be asking the child which color, design, shape he or she would like to wear, much like an orthodontist gives a child an array of choices for a retainer. Imagine what the impact for child acceptance of amplification would be if they could choose a watermelon design or even better, a glow-in-the-dark hearing instrument!

The paradigm, or view, of amplification is largely determined by the audiologist in the initial fitting. When choices are given to select a color that matches one's hair, the audiologist is actually teaching the parent and the child that this instrument should be concealed. This in turn may be interpreted as this hearing loss is a negative aspect that should be hidden, a belief that can create a huge roadblock for accepting further accommodations such as neckloops or remote microphones. The more the family can be included as the audiologist displays excitement for the colors and styles of instruments and earmolds, the more likely the child will maintain a positive self-image while wearing the hearing instrument.

Opportunities for students with hearing loss to share feelings with other students may facilitate acceptance of the loss. Message boards and other online resources are provided by the A.G. Bell Association for teens at www.hearourvoices.org/

Likewise, A.G. Bell also provides similar support groups for parents they can be found at www.agbell.org

Other useful organizations include the Hearing Loss Association of America at www.hearingloss.org and The American Society for Deaf Children at www.deafchildren.org/asdc/

4. Interfacing FM equipment with Hearing Instruments

Although the benefits of FM technology have been well documented (Boothroyd, 2005; Lewis, 1994; Smaldino & Crandell, 2000; Weihing, 2005) the options and verification of signals have become quite complex. This complexity may be so great that an audiologist may be tempted to suggest an FM is not necessary because there is not adequate time to determine the correct connection, the software to program the receiver, and/or select the most appropriate transmitter. The clinical audiologist must be in contact with the educational system of the children they serve so that the hearing instruments selected for a child may be compatible with FM technology provided by the school. This may make the difference in a child having a body vs. an ear-level receiver if their hearing instrument has DAI. It is also imperative that the school be informed of the need for the FM fitting evaluation to verify the FM and hearing aid settings are appropriate. The audiologist can also reinforce the benefits of the FM technology by asking how the hearing instrument is used at school with the FM. They may also be instrumental in teaching the child additional ways to benefit from their FM by using it to directly receive the signal from a classroom or home computer or other technologies.

Many resources are available to support use of FM. Some are supported by manufacturers such as the eSchool Desk by Phonak at www.eschooldesk.com

Others may provide more specific information such as troubleshooting tips for interfacing FM with hearing aids, cochlear implants, or classroom technology at www.utdallas.edu/~thib

With the variety of available resources, audiologists must make sure that families are informed of the options that may interface with their technology. As schools expand services and children are increasingly served in the mainstream, there are instances where technology specialists rather than audiologists are given the task of selecting, ordering, and providing the FM system. Hopefully, prior to encountering a recommendation from the school, a parent would have discussed options with the audiologist and be prepared to request the appropriate equipment and the necessary FM fitting evaluation to ensure settings for optimal speech recognition.

5. Hearing Instruments and Transitions from High School

Parents of teens with hearing loss may have great fears of hearing complications during that first experience away from home. This may be a college dormitory or an apartment. There is much information to be considered to make this transition as smooth as possible and to take advantage of programs such as state supported "tuition grants." Teens need to determine their own needs, e.g. flashing smoke alarm or notetakers, and then know how to place the requests for such accommodations. For those going to college, having met a counselor from the Office for Students with Disabilities can be very reassuring to not only the student but also the parent. Providing this information may require a group setting or interaction with service providers at the university. Initially, a review of basic ideas is needed followed by research regarding a student's particular needs in more detail. The highly effective audiologist might keep an excel file of patients and their graduation dates, so they may be notified no later than the start of their senior year of special informational sessions on "Transitions after High School."

A tutorial regarding transition needs of students with hearing loss who have completed high school is available at www.utdallas.edu/~thib

6. Hearing Instruments and Coping Skills

No doubt children are going to receive negative comments from peers at some time that are prompted by seeing the hearing instruments. Rather than trying to "hide" the devices so that such comments are not aroused, audiologists can teach the child and parent some ways to cope with such negative comments. In addition, children need to be learning skills to recover from communication breakdowns with a response other than "huh." Because it may be difficult to discuss these skills during a routine audiological appointment, audiologists may consider group meetings, referral to speech-language pathologist, and/or the use of materials designed for self instruction. [Sam Trychin](#) has provided workbooks that address several areas of coping and additional resources are available at [Hear Again Publishing](#). Parents and older children may want to view this information at home through accessing information on the internet.

A review of coping skills can be found at www.utdallas.edu/~thib

An example of a positive coping strategy is the way an individual may acknowledge a communication breakdown. Negative phrases such as "you talked too fast, please repeat" are not as well received as neutral or more positive phrases. For example, just as persons with normal hearing might have to say, "Excuse me, my cellphone is cutting out", the user of amplification may also say, "Excuse me, my technology didn't work, could you repeat that?" Teaching individuals this coping strategy helps to remove the emphasis on the hearing loss, and refer to the technology to restore hearing which may, in turn, lead to great self-acceptance.

7. Hearing Instruments and Assistive Technology

Equally important to the hearing instrument are the assistive devices that allow the child access to developing independence like a child would with normal

hearing. Therefore, as soon as the child is old enough to understand the gesture for "come" and is independently mobile to the point of not always being in the same room with a caregiver, it is time to introduce the flashing smoke alarm. It would be unfortunate for a family to suffer a loss that might have been prevented had an audiologist recommended a flashing smoke alarm.

Just as children develop independence by knowing the meaning of the flashing light for the smoke alarm, they should also be trained to waken independently. This may be accomplished via an audible signal, but may require a vibrating alarm clock. The audiologist's role in this may simply be to ask how the child is responding to auditory signals in the environment and then provide a referral for acquiring an accommodation, perhaps even through the internet. A tool for adults has been developed, known as the "TELEGRAM" to facilitate this interview process for assistive technology to guide audiologists to asking questions in all areas of potential communication difficulty (Thibodeau, 2004). As shown in Figure 2, the TELEGRAM provides a grid to plot difficulty across an array of areas much like the audiogram allows plotting of thresholds. An additional version of the TELEGRAM adapted for children has been released and is available on the author's web site (see below). Perhaps through the use of a convenient tool such as this, the questions and possible solutions may be more readily addressed.

The TELEGRAM adapted for children may be accessed at www.utdallas.edu/~thib It may be used as a prompt to review potential areas of need for assistive technology and/or informational counseling.

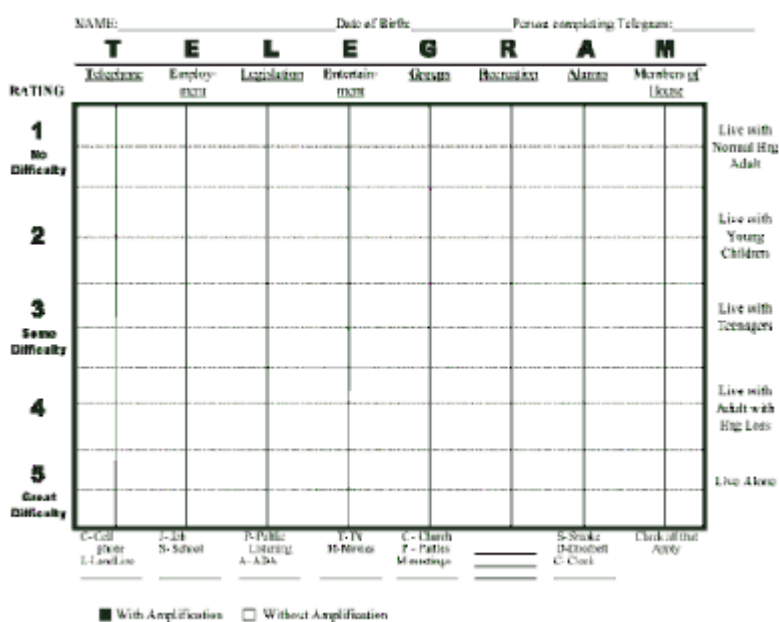


Figure 2. TELEGRAM for adults from Thibodeau, 2004, reprinted with permission.

Summary

The seven habits of highly effective audiologists who serve children are interrelated and mutually supportive. Each one has an impact on the other six in some way as shown in Figure 1. For example, if the child is taught to hide the hearing instrument, he will most likely reject an FM system, not seek accommodations at college, avoid use of repair strategies, and reject larger instruments that have DAI and t-coil. If one of these areas is neglected entirely, the interrelations may become skewed and other areas may suffer. For example, if verification is ignored, the optimal acoustic characteristic may not be recommended and the child might miss important speech sounds and consequently reject not only the hearing instrument but also other assistive technology. Although audiologists may not practice all seven of the habits extensively, efforts may begin with directing the families to finding information on the internet or through written materials for those areas here-to-fore neglected. Likewise, many of these areas may be addressed through sharing information through parent discussion groups.

As it becomes more routine for all audiologists to address these seven areas in service delivery, there will certainly be improved hearing health care for children and their families.

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