Practical Information for Audiologists on Access to Wireless Telephones

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Abstract

Analog cellular telephone service is being phased out in favor of digital wireless services, which are less accessible to people with hearing loss. As a result, audiologists can expect to receive an increasing number of inquiries from clients about using wireless telephones with hearing aids and other assistive technologies. In this article, the underlying transmission technology, telephone handset, roaming, and current solutions to accessibility problems are described. Public policy affecting the accessibility of wireless telephones to people with hearing loss is explained. Alternatives to wireless voice services are explored, and resources for information in a quickly changing industry are provided.

Key Words: Accessibility, hearing aids, telephones, text telephone

Abbreviations: CDMA = code division multiple access, FCC = Federal Communications Commission, GSM = Global System Mobile Communications, HAC = hearing aid compatible, TDMA = time division multiple access, TTY = text telephone

Until recently, the most reliable advice for using a wireless telephone with a hearing aid, cochlear implant, or text telephone (TTY) was simple: choose analog cellular service and telephones. Analog cellular phones do not cause buzzing in hearing aids, and some models are hearing aid compatible (HAC). Analog cellular phones do not garble TTY messages. Cochlear implant users can connect their processor to the audio jack of many analog cellular telephones. Because analog technology was used nationwide in cellular telecommunications for many years, coverage has in the past been quite good, and every market had some carriers offering analog service.

Unfortunately, this simple advice is no longer very helpful. Analog service is being phased out. Many wireless carriers offer no analog service, and some carriers that used to offer it have discontinued the service. Even where it is available, analog service is generally much more expensive than digital service.

In the 1980s, only two carriers could operate cellular services in each market. The network capacity of the analog cellular network was limited; thus, the number of subscribers could not grow quickly without overwhelming the networks. In the mid-1990s, the federal government deregulated wireless telecommunications, and the Federal Communications Commission (FCC) sold spectrum to encourage competition, growth, lower prices, and use of new technology. The FCC did not mandate a single transmission technology for the country but decided to let market forces determine which technologies would succeed. As a result, several types of digital wireless technology are in use. These technologies are incompatible with each other, but they are “interoperable,” meaning that a subscriber on one service can call a subscriber on another. The call is routed through the wireline network to make this possible.

After the spectrum auctions, the wireless industry invested heavily in a highly competitive race for the untapped market for mobile telecommunications. Companies invested in digital technologies because of the numerous business advantages offered, increased network capacity being one of the primary motivations.

The increased capacity soon found its market. Today, wireless telephones are commonplace. The Cellular Telecommunications Industry Association estimates that there were 108 million subscribers in the United States as of January 2001. The annual growth rate last year was
over 27 percent, and the sustained annual rate of growth has been 20 percent or more throughout the 1990s (CTIA, 2001).

Competition and improvements in technology have driven down the cost of using a wireless telephone. Service plans blur the distinction between local and long distance calls by offering “buckets” of minutes for calling anywhere in the United States. Service providers also make wireless services more attractive by bundling popular services, such as voice mail, with the basic service. Prepaid service is a product that eliminates the monthly fee and charges strictly by length of call. As a result of lower costs and more choices, a small but growing number of people are choosing to forego traditional wireline service in favor of wireless service. Wireless telephones are also becoming indispensable in many occupations. Emergency calling and reporting of accidents have become an important use of wireless telephones; in 1998, more than 31 million people made 9-1-1 calls from wireless telephones. The traditional concept of a telephone as a fixed appliance is gradually giving way to the expectation that telephones will accompany people wherever they are for “anytime, anywhere” communication.

The beginning of the 21st century is an important time with regard to accessibility of wireless service. When a technology is on the periphery of someone’s experience, the accessibility may be of low priority, but the urgency of accessibility tends to grow along with the technology’s impact on the individual’s health, employment, education, public safety, integration with others, and ability to function independently and in essentially the same manner as others in society. It is expected that audiologists will be receiving an increasing number of queries and complaints from consumers in the next several years.

Of course, it is not only the telephone that is at issue but also the hearing device. Hearing aid immunity to interference is an important issue, and audiologists play a vital role in helping consumers communicate their experiences and problems to hearing aid manufacturers. This article, however, is intended to provide information about an industry with which audiologists have far less contact—the wireless industry.

PUBLIC POLICY

The U.S. Congress has enacted a number of laws requiring that telecommunications products be accessible. Under Section 255 of the Telecommunications Act of 1996, the industry is required to make its products accessible to and usable by people with disabilities if it is readily achievable to do so. The term “readily achievable” means without much difficulty or expense, relative to the size of the company. If it is not readily achievable to make a product directly accessible, then this can be achieved by compatibility with assistive technologies. Manufacturers must make their products compatible with the customer’s specialized equipment, again if readily achievable to do so.

The FCC enforces Section 255 (Federal Communications Commission, 1999) and requires that each telecommunications company identify a single point of contact for accessibility issues. This person or office can be a valuable resource for finding answers to specific questions if help is unavailable from the retail outlet for the wireless manufacturer or carrier. The names and contact information for the single point of contact can be found on the FCC’s Web site, at www.fcc.gov/cib/dro.

The Hearing Aid Compatibility Act requires that wireline telephones manufactured for sale in the United States must be HAC. However, the FCC relieved the wireless industry of this responsibility, largely because the law was passed while the wireless industry was still young. Consumer groups have recently petitioned the FCC to study changes in the industry and to apply this law to digital wireless telephones, but the outcome of this petition is not yet decided (FCC, 2000a).

The FCC did order the wireless industry to ensure that wireless services be compatible with TTYs, within a much broader order on access to emergency telephone services (9-1-1). The deadline for compliance has recently been extended to June 30, 2002 (FCC, 2000b).

WIRELESS SERVICE AND EQUIPMENT

To use a wireless telephone, the customer must sign up for a subscription with a service provider, also called a carrier. Each service provider’s network is composed of telecommunications equipment supplied by manufacturers. The service provider also develops specifications for the handsets that may be used within its network and enters into agreements with handset manufacturers for providing a limited number of models to the marketplace. The models that work on a given service are said to be “supported” by that provider. Information about current models can be found on most service providers’ Web sites.
providers' Web sites. The handsets may be bought in any of a variety of retail outlets (e.g., appliance stores, office supply stores, the carrier’s retail store), via telephone, or via the Web. The retailing of wireless telephones has diversified, becoming more flexible for the general consumer but often in the hands of sales personnel who are not specialists in wireless telecommunications. In general (unless the consumer already knows of a product that will work with the assistive device), it is advisable for consumers who use assistive devices to go to a retail outlet of the carrier to explain their unique situation and try out telephones. Although there is no guarantee that they will encounter knowledgeable personnel, there is a greater likelihood that someone in the organization will at least be aware of the problem and be able to help.

Many carriers of digital wireless service use one of several available digital technologies in their network. The four types of transmission technology used are time division multiple access (TDMA), Global System for Mobile Communication (GSMC), integrated digital enhanced network (iDEN), and code division multiple access (CDMA). Table 1 shows examples of carriers and the digital technologies that they are licensed to use as of January 2001. This information was obtained from the Web site Wireless Advisor (www.wirelessadvisor.com), which provides information, based on the results of spectrum auctions, on spectrum and technologies used by the carriers; the site also links to some carriers’ sites. The type of digital network technology may be important to a hearing aid wearer or TTY user because some people will have more success with some transmission technologies than with others. Often, the carrier does not advertise the type of technology used on its own Web site or in its print advertisements.

ROAMING

The wireless industry is very dynamic. Some large carriers (e.g., Southwestern Bell, Verizon) have acquired other large carriers through mergers, and in some cases, the wireless network of the acquired carrier uses a different technology. This means that some carriers’ telephones will be transmitting in more than one digital technology when “roaming”—the industry’s term for moving outside the subscriber’s home area. Currently, roaming between digital technologies typically occurs between TDMA and GSM or between two radio frequency bands—800 and 1900 MHz—using the same underlying technology. For such roaming to be successful, the telephone handsets must be equipped for dual- or tri-mode transmission (also sometimes called dual band if it is roaming between frequency bands).

Some carriers use analog technology when the customer is roaming into areas not served by their digital network. This is especially the case in rural areas. The dual-mode wireless telephones in this case can operate in either analog or digital mode. When this capability is used as a marketing feature, there can be some consumer confusion. Some consumers have

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<tr>
<th>Service Provider</th>
<th>Digital Technology</th>
<th>Frequency Band (MHz)</th>
<th>Comments</th>
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<tbody>
<tr>
<td>AT&amp;T Wireless Services</td>
<td>TDMA</td>
<td>800 and 1900</td>
<td>Neckloop (telecoil) accessories available through service provider</td>
</tr>
<tr>
<td>Cingular Wireless (formerly Cellular One and other brand names)</td>
<td>TDMA</td>
<td>800</td>
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<td></td>
<td>GSM</td>
<td>1900</td>
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<tr>
<td>NexTel</td>
<td>IDEN</td>
<td>800</td>
<td>All handsets are from Motorola; neckloop available through Motorola</td>
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<tr>
<td>Qwest</td>
<td>CDMA</td>
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<td>Sprint PCS</td>
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<tr>
<td>Verizon Wireless (formerly Bell Atlantic Mobile Systems)</td>
<td>CDMA</td>
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<td>VoiceStream Wireless</td>
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seen advertisements of telephones as dual mode analog/digital and believed that this was a solution to their accessibility problem. However, dual-mode telephones no longer allow the user to select analog service for a call. The network's computers choose which channel and technology will be used.

**CURRENT STATUS OF SOLUTIONS TO ACCESSIBILITY PROBLEMS**

Ring signaling may need to be the first consideration in selecting a handset, especially if the consumer ordinarily has difficulty hearing telephones ring. Note that many wireless telephones offer a choice of rings, some in the form of tunes, which may enhance the alerting function. However, the most reliable method of alerting for a person who has a hearing loss in a mobile situation is vibration. Vibrating handsets, batteries, and remote vibrating accessories can be used in place of the audible ring, and the handset can be kept in a pocket or on the waistband. Not all handsets support this function, which is typically called "silent mode" in industry parlance.

Hearing aid wearers who wish to use the telecoil in their aids cannot use current digital wireless telephones in the traditional manner, that is, with the handset held near a hearing aid set on "T." However, they may be able to use digital wireless telephones with an inductive-coupling accessory such as the neckloops that have been developed by Nokia and Motorola. Such devices are hands-free accessories with a built-in microphone. Their function is to provide HAC and to distance the handset from the hearing aid to avoid possible interference. The handset can be clipped to a waistband or carried in a pocket. The added advantage is, of course, virtually hands-free operation. Such accessories currently cost approximately $120 from manufacturers, but some carriers are offering selected models at about half that price. Note that the Nokia neckloop works only with specific models of Nokia telephone and that this limitation could, in turn, affect the choice of carrier.

Hearing aid wearers who do not have telecoils in their aids or who do not wish to use an accessory may need to experiment with various handsets and even various carriers since the digital wireless technologies vary in the degree of interference with specific hearing aids and also in the properties of the interference noise (Ross, 2001). Handsets with antennas that point away from the ear may interfere less. Some accessories claim to direct the antenna's radio frequency emissions away from the head; the author is unaware of any published test results on their success in reducing interference. It should be noted that some hearing aid wearers will not experience bothersome interference at all.

Audiologists can help clients who have experienced bothersome interference while trying out a phone by using the information in Table 1 to identify a carrier that uses a different transmission technology from the one that was tried. This variable is sometimes difficult for consumers to grasp because their ability to use a wireline telephone service has traditionally depended on the telephone itself, not the carrier. A handset that works on Verizon's service may appear identical to one that works on VoiceStream's service, but its usability by hearing aid wearers may be quite different.

For those who have cochlear implants, the issues are similar to those for the hearing aid wearer who does not have a telecoil (unless the cochlear implant is one of few that are equipped with a telecoil). At the present time, there is no patch cord for direct connection between the processor and a digital wireless telephone, although this situation could change.

For those who use TTYs, there are two basic issues: the cord connection between the telephone and the TTY and the ability to pass the TTY signals without garbling. Currently, two TTY manufacturers, Ultratec and Ameriphone, offer audio jacks for direct connection to the audio jack of wireless telephones. The user will need to purchase a hands-free adapter from the wireless telephone manufacturer. (Currently, most digital wireless telephone manufacturers use proprietary connectors to limit consumer choice to their own company's accessories.) Regarding the choice of transmission technology, consumers may wish to try one of the GSM carriers with their TTYs (if one is available in their area) to determine if the transmission is acceptable. At the present time, it appears that GSM is the best of the digital technologies for carriage of TTY signals. However, the caveat about roaming may apply if the carrier roams to other technologies that garble TTY to a greater extent.

One of the challenges faced by consumers is that network conditions can affect the usability of a device. A telephone can be usable at one location or time but unusable at another, depending on how much power is required to maintain the telephone's contact with the base station or on how congested the network is at a given moment. For this reason,
it is very desirable for wireless service providers to grant a trial period to people who use assistive technology for telephone communication. There is no government requirement of a trial period, but it is hoped that service providers will do this voluntarily (30 days should be adequate). If not, the next step would be to contact the Section 255 point of contact for the service provider should a problem arise with using the telephone. If the company is unresponsive, the last resort would be to contact the FCC's Disability Rights Office (access@fcc.gov), which will be tracking consumer difficulties with access to telecommunications.

**Alternatives to Voice Services**

Many consumers who have hearing loss are finding interactive pagers to be extremely effective for mobile communications. These products offer electronic mail, two-way messaging, fax service, and traditional paging. Some companies, notably Wyndtell and Reachnet, offer live interaction with TTYs, including relay service. Because the devices are compact and all in one piece, and because they include vibrating alerts, they are a good substitute for a wireless telephone for many people.

The wireless telephone industry is beginning to offer comparable data services as well. Manufacturers are beginning to introduce devices that combine the functions of telephone, pager, and personal digital assistant, and new data services are also being introduced.

**Looking Forward**

A standard for measuring the emissions of wireless telephones and the immunity of hearing aids has recently been approved by the American National Standards Institute (ASC C.63.19). (As of this writing, the standard's number has not been assigned.) The underlying purpose of the standard is described in detail in Berger (2001). Depending on how the standard is implemented by the industry, the outcome may be greatly improved information for audiologists and consumers. If tests are run by manufacturers and their results are made available, it may be possible to help a consumer select a handset based on the known characteristics of the hearing aid and/or select a hearing aid based on known immunity characteristics relative to wireless telephones and other devices that have radio frequency emissions.

The requirement that wireless services become compatible with TTYs is scheduled to take effect in mid-2002. Interactive paging products are helping to fill the void caused by the lack of access to wireless telephones via TTY.

Section 255's impact on accessibility is already being realized in the introduction of new accessories for using wireless telephones with hearing aids. Over time, it is likely that more improvements in accessibility will occur. As analog service is phased out, this will become increasingly important.

**Keeping Up**

To track trends in wireless telecommunications, mainstream publications such as *Consumer Reports*, *Popular Science*, and *Wired* and newspapers are excellent sources of new information. All of the wireless telecommunications companies have Web sites, and the Cellular Telecommunications Industry Association provides information on accessibility (www.wow-com.com). With regard to the issue of interference with hearing aids, research centers' Web sites and the Self-Help for Hard of Hearing People (SHHH) Web site are sources of information. *Hearing Loss* will continue to carry articles on this issue as progress is made. Research and clinical journals will also carry new findings. It is hoped that, in the future, more information for hearing aid wearers will appear on the Web sites of wireless telecommunications companies. Service providers will continue to be an important source of customer information, although this will vary greatly from company to company. The efforts of some of these companies are described elsewhere in this issue.

**Acknowledgment**

This article was supported by the National Institute on Disability and Rehabilitation Research through grant #H133E50002. The opinions expressed here are those of the author and not the NIDRR.

**References**


Information on Access to Wireless Telephones/Harkins


