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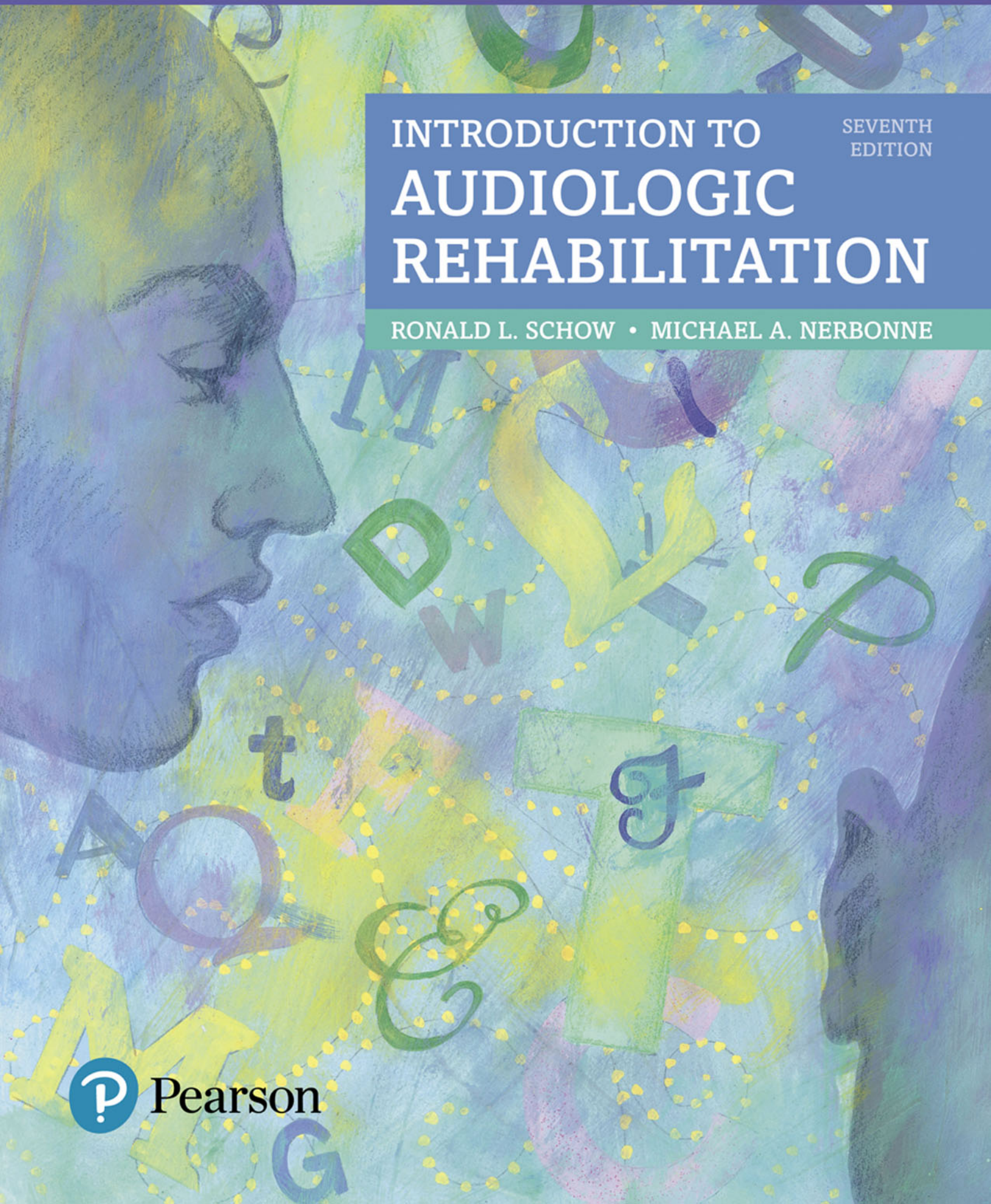

INTRODUCTION TO AUDIOLOGIC REHABILITATION

SEVENTH EDITION

RONALD L. SCHOW • MICHAEL A. NERBONNE

Pearson

Introduction to Audiologic Rehabilitation

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SEVENTH EDITION

Introduction to Audiologic Rehabilitation

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Dedicated to our friends and colleagues who have contributed to this book throughout all of the editions since 1980.

Preface

Our introductory text first appeared in 1980 and has been used on college campuses for 37 years. It is with profound gratitude and pride that we now bring you the seventh edition.

During the years since 1980, we have watched cochlear implants move from their early beginnings in 1972 to become a major miracle for children born deaf and for others, including late-deafened adults. Traditional hearing aids also have shown tremendous advances during these years. They are more accepted and technologically more sophisticated, and they now enjoy wider usage among those with hearing loss, which has moved from 20 to 30 percent, a 50 percent improvement. However, both hearing aids and cochlear implants simply do not produce maximum benefit and satisfied users without a lot of support and technical help from hearing professionals.

Hearing assistive technology (HAT) devices as spurred by the miracle of the Internet, cell phones, and wireless technologies, and their associated software and hardware also present us with a vastly changed environment and are more easily used and accepted by those with hearing loss. HAT also requires professionals to provide strong support and encouragement.

Many of the 32 million persons with hearing loss in the United States and an estimated 10 percent of the worldwide population of more than 7 billion will not take advantage of these modern miracles until they learn of them and are shown how to find benefit by those using this book. This expertise by well-trained professionals is needed among adults and children.

Those who serve adults in private practice, medical settings, veterans clinics, and other settings are more skilled and available than ever before. Now that the baby-boom generation is beginning to reach retirement age, the proportion of the population with hearing loss is increasing dramatically such that even more older adults will need the help of rehabilitative audiologists in the coming years. The increasing numbers of the oldest old, including those with coexisting health issues, will place new demands on rehabilitation tailored to their needs and the needs of their caregivers in the context of new interprofessional team approaches.

Parent–infant professionals, school audiologists, speech-language pathologists, and a wide circle of other professionals help make referrals and marshal an important group to provide the support needed within families, preschools, and schools to help children benefit from these new developments.

During these years, with the emergence of the Au.D. in audiology, students in the university setting have been getting better and more extensive training than in the past. Students have also benefited increasingly from the support of professional associations that have provided guidelines and follow-up training after graduation to keep professionals up to date as new developments have rapidly emerged. The maturity of rehabilitative audiology is reflected in research that has given us higher-quality evidence of what interventions are effective. Client-centered and family-centered audiologic rehabilitation have advanced because of new procedures and developments based on evidence and more global multicultural understandings of the needs of those living with hearing loss.

We have been fortunate during these years to have worked with some amazing authors who have assisted in keeping this text current and relevant. We are immensely grateful to all of them, including those who have helped with this edition. They are thorough, have enviable expertise, and are among the best in our profession.

With their assistance, we have improved this new seventh edition by adding the following new features and changes:

- Our web design wizard, Jeff Brockett, has updated and improved the text website. Check it out at www.isu.edu/csed/audiology/rehab.
- Chapter 3 has been revised to focus on cochlear implants only.
- New learning outcomes have been added to each chapter.
- Updated information and references are included in all chapters.
- Updated websites also are provided in all chapters.
- New supplementary learning activities are provided in the chapters.
- Revised vestibular and tinnitus treatment sections are now placed in Chapter 10.
- New case studies have been added to Chapters 11 and 12.

Some of these improvements were made at the suggestion of a group of five reviewers whom we thank for their input: Stephanie Adamovich, University of Arizona; Lindsay M. Bondurant, Ph.D., Illinois State University; Demarcus Bush, Au.D., South Carolina State University; Julie L. Hazelbacker, Ohio State University; and Sarah Dawson Wainscott, Texas Woman's University.

We also thank our families and colleagues for their encouragement and enduring support as well as the universities that have sustained us all these years. They all have been truly remarkable to us throughout the nearly four decades that we have worked on this text.

Finally, we are pleased to have brought into our working group a set of new professionals for this edition. They will carry this text forward into the future as the two of us transition into another phase in our lives. These individuals will ensure that this text will continue to be a force in audiology for years to come.

Ron Schow
Mike Nerbonne

A website at http://www.isu.edu/csed/audiology/rehab/ has been updated to supplement and complement this edition. Not only has the content changed but all interactive files are now in a format that can be accessed on laptop, tablets and mobile phones. Some examples of content include: hearing loss simulation and classification, cloze procedure simulation, and a dB reference level activity. The laptop icon in the chapter margins indicates where related content is included on the website.

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Fundamentals of Audiologic Rehabilitation

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1

Overview of Audiologic Rehabilitation

Ronald L. Schow, Michael A. Nerbonne, and Chris A. Sanford

CONTENTS

Visit the companion website when you see this icon to learn more about the topic nearby in the text.

Learning Outcomes

After reading this chapter, you will be able to

- Define audiologic rehabilitation and the primary goals associated with this process
- Be aware of the general estimates of hearing loss prevalence for children and adults in the United States and worldwide, and understand the difference between *deaf* and *hard of hearing*
- Understand environmental factors and personal factors in the way they influence hearing loss, based on the World Health Organization (WHO) model of functioning and disability. Give examples of each and compare them
- Explain how the suggested use of the terms *activity limitation* and *participation restriction* by WHO helps individuals properly understand the consequences of hearing loss
- Know the main professional associations and the importance of evidence-based practice and multicultural issues
- Describe the key components of the CORE and the CARE models and explain how these components influence audiologic rehabilitation
- Identify the variety of different health care providers who contribute to the coordination and implementation of audiologic rehabilitation
- List some of the recent technological advances that have led to improvements in audiologic rehabilitation

INTRODUCTION

Many individuals have had occasion to converse with someone who is deaf or hard of hearing. Unless the communication partners have alternative means of communicating (such as sign language) or the individual who is deaf or hard of hearing has received some type of assistance for his or her hearing difficulties, it may be a frustrating experience for both parties. When the person with hearing loss is a family member or close friend, we become aware that the emotional and social ramifications of this communication barrier can be substantial as well. Providing help to address all these hearing challenges is the focus of this book. While help is possible, it is often not utilized. This chapter gives an overview of this process, which is crucial for the welfare of persons who suffer from hearing loss and, in turn, for those who communicate with them.

Definitions and Synonyms

Audiologic rehabilitation: Professional processes performed in collaboration with a client who has hearing loss and the client's significant others to achieve better communication and minimize the resulting difficulties.

Simply stated, we may define *audiologic rehabilitation* as those professional processes performed in collaboration with a client who has hearing loss and the client's significant others to achieve better communication and minimize the resulting difficulties (American Speech-Language-Hearing Association [ASHA], 2001; Stephens & Kramer, 2010; World Health Organization [WHO], 2001).

- The goal is to enhance the *activities* and *participation* of a person with hearing loss so as to improve his or her quality of life. Achieving adequate receptive and expressive communication is a major means of reaching this goal.
- The processes/procedures include the use of devices to minimize the hearing loss and teaching strategies and problem solving, which in combination assist the individual to overcome interpersonal, psychosocial, educational, and vocational difficulties resulting from the hearing loss.
- A clear objective is to involve family members or significant others to limit the negative effects on these relationships.
- Finally, it is important for the individual to accept and come to terms with any residual problems associated with hearing loss.
- Two important services that are closely related but distinct from the audiologic rehabilitation process are *medical intervention* and *education of the deaf*.

Audiologic habilitation is sometimes used to refer to those efforts to assist children with hearing loss since we cannot rehabilitate something that was never there in the first place. Nevertheless, for simplicity's sake, audiologic rehabilitation (AR) is used throughout this text.

Several terms have been used to describe this helping process. *Audiologic habilitation* refers to remedial efforts with children having a hearing loss at birth since technically it is not possible to restore (rehabilitate) something that has never existed. *Audiologic rehabilitation*, then, refers to efforts designed to restore a lost state or function. In the interest of simplicity, the terms *habilitation* and *rehabilitation* are used interchangeably in this text, technicalities notwithstanding. Variations of the *audiologic rehabilitation* term include *auditory and aural rehabilitation*, *hearing rehabilitation*, and *rehabilitative audiology*. Terms used to refer to rehabilitative efforts with the very young child include *parent advising/counseling/tutoring* and *pediatric auditory habilitation*. *Educational* (or *school*) *audiology* is sometimes used to refer to auditory rehabilitative efforts performed in the school setting.

Providers of Audiologic Rehabilitation

Audiologic rehabilitation (AR), then, is referred to by different names and is performed in a number of different settings. All aspects of assisting the client and significant others in the audiologic rehabilitation process are not performed by one person. In fact, professionals from several different disciplines are often involved, including educators, psychologists, social workers, and rehabilitation counselors. Nevertheless, the audiologist in particular—and frequently the speech–language pathologist or the educator of the deaf—will assume a major AR role. These professionals provide overall coordination of the process or act as advocates for the

person with hearing loss. Audiologic rehabilitation is not something we *do* to a person following a strict "doctor-knows-best" medical model. It is a process designed to counsel and work with persons who are deaf and hard of hearing so that they can actualize their own resources in order to meet their unique life situations. In addition, an individual's family, which could be defined as simply the individual alone or most often includes a partner, spouse, parent, or children, can be a valuable resource in the rehabilitation process (Ekberg, Meyer, Scarinci, Grenness, & Hickson, 2015). This so called family-centered care is generally thought to result in improved health outcomes, improved faithfulness to treatment recommendations, and increased satisfaction with medical services (Rathert, Wyrwich, & Boren, 2013). Therefore, inclusion of the family in the rehabilitative process should not be overlooked. This text has been written with the hope of orienting and preparing professionals as "counselors" or "advocates for better hearing" so that they can be effective participants in the problem-solving process.

Education Needs of Providers

There are multiple professionals involved in a rehabilitation team; most often, speech-language pathologists and/or audiologists lead the team. The entry-level degree for speech-language pathologists is the master's degree. From the audiologic perspective, there is now a well-established professional degree, the Doctorate in Audiology (Au.D.), that is the minimum educational requirement for those beginning work as audiologists. The major professional bodies for these professions include the American Speech-Language-Hearing Association (ASHA) and the American Academy of Audiology (AAA). These organizations, along with the Academy of Rehabilitative Audiology (ARA), all have position statements that emphasize the training needs of students so that they can be well prepared in both diagnostic and rehabilitative audiology. These statements generally have a list of relevant content areas in AR that should be incorporated into any program to ensure adequate preparation in rehabilitative audiology. These are available on a resource website (www.isu.edu/csed/audiology/rehab) that goes with this text (see AAA, ASHA, and ARA statements on competencies for AR).

To participate in AR, you need to know the characteristics of hearing loss, the effects of the loss, and the methods for remediation.

Regardless of academic background, those from the different professions mentioned in the previous section who successfully perform AR must, like competent audiologists, possess an understanding of and familiarity with several areas of knowledge. These include (1) characteristics of hearing loss, (2) effect of hearing loss on persons, and (3) the previously noted competencies needed for providing audiologic rehabilitation. For purposes of the present treatment, it is assumed that other course work or study has brought the reader familiarity with the various forms of hearing loss as well as procedures used in the diagnostic measurement of hearing loss. These procedures, referred to as *diagnostic audiology*, serve as a preliminary step toward rehabilitative audiology. The task at hand, then, is to review briefly some characteristics of hearing loss, to explore the major consequences of such loss, and finally to discuss the methods and competencies needed to help with this condition.

HEARING LOSS CHARACTERISTICS

Important characteristics of hearing loss as they relate to audiologic rehabilitation include (1) degree and configuration of loss, (2) time of onset, (3) type of loss, and (4) auditory speech recognition ability.

Degree of Hearing Loss and Configuration

One major aspect of hearing loss is the person's hearing sensitivity or degree of loss (see Table 1.1). The amount of loss will vary across the frequency range, leading to

TABLE 1.1 Degree of Hearing Loss Descriptions, Based on Pure Tone Findings

Degrees of Hearing Loss	PTA in dB Based on 0.5, 1, 2 k[a]Hz[b]		
	Children		Adults
Slight to Mild	21–40		26–40
Mild to Moderate	—	41–55	—
Moderate	—	56–70	—
Severe	—	71–90	—
Profound	—	91 plus	—

[a]k = 1000.

[b]The three frequencies of 0.5, 1, and 2 kHz routinely are used for interpreting audiograms and comparing to SRTs. Higher frequencies, including 3 kHz and 4 kHz, should be considered in hearing aid fitting decisions and compensation cases.

different configurations or shapes of hearing loss on an audiogram, including the most common patterns of flat, sloping, and precipitous. (Practice in degree and configuration interpretation is provided on the website.) The categories of hearing loss include both the hard of hearing and the deaf. Persons with limited amounts of hearing loss are referred to as being *hard of hearing*. Those with an extensive loss of hearing are considered deaf. Generally, when hearing losses, measured by pure-tone average (PTA) or speech recognition threshold (SRT), are poorer than 80 to 90 dB Hearing Level (HL), a person is considered to be *audiometrically deaf*. However, deafness can also be described functionally as the inability to use hearing to any meaningful extent for the ordinary purposes of life, especially for verbal communication. This latter way of defining deafness is independent of the findings from audiometric test results.

A reasonable estimate is that 10 percent of the population has hearing loss. In the United States, this includes about 32 million persons (as of 2017), but this counts only the most serious problems and not minor hearing difficulties.

The prevalence of hearing loss may be considered for all persons combined and for children and adults separately. In the United States, the prevalence of hearing loss is estimated to be from 14 million to 40 million, depending on whether conservative or liberal figures are used (Goldstein, 1984; Lin, Niparko, & Ferrucci, 2011; Schow, Mercaldo, & Smedley, 1996). These estimates vary depending on the definition of loss; the loss may be self-defined or involve different decibel fence levels, some as low as 15 dB HL, but most are higher, commonly 20 to 25 dB HL. Prevalence estimates increase to 48.1 million when individuals with a unilateral hearing loss are included (Lin et al., 2011). Authorities have suggested that a different definition of loss should be applied for children because in a younger person the consequences are greater for the same amount of loss. The prevalence of loss also varies depending on whether the conventional pure-tone average (500, 1000, 2000 Hz) is used or whether some additional upper frequencies (such as 3000 and 4000 Hz) are included. In this book, we recommend that different pure-tone average fences be used for children and adults at the "slight-to-mild" degree of loss level, although the degree designation is similar at most levels. In addition, we recommend that either 3000 or 4000 Hz be used in evaluating loss, although the usual three-frequency pure-tone average will typically be used in analyzing audiograms. Table 1.1 indicates that a hearing loss is found in children at a lower (better) decibel level than in adults; this is consistent with ASHA screening levels for schoolchildren that define normal hearing up to and including 20 dB HL (ASHA, 1997). A reasonable estimate from recent prevalence studies would be that at least 10 percent of the U.S. population has permanent, significant hearing loss. Using 10 percent as of 2017, this is approximately 32 million individuals in the United States and 737 million worldwide. Approximately one-third of 1 percent of the total

U.S. population is deaf (about 1 million). Thus, the remaining 31 million are in the hard of hearing group (Schow et al., 1996; U.S. Census Bureau, 2017). WHO uses about 5 percent and estimates that 360 million people worldwide have a disabling hearing loss, which is defined as hearing loss more severe than 40 dBHL in the better-hearing ear in adults and a hearing loss more severe than 30 dBHL in the better-hearing ear in children (WHO, 2015).

Children form a subpopulation of the total group of 32 million individuals with hearing loss. It is estimated that up to 3 million U.S. children are deaf and hard of hearing, and even more fit in this category if high-frequency and conductive losses

Audiometric Patterns of Hearing Loss Using Degree and Configuration

In rehabilitating adults, audiologists may use degree and configuration of loss to group those who are hard of hearing, thus focusing on the most common audiometric patterns. While a focus on the audiogram alone involves a simplification of the many variables discussed in this chapter, it nevertheless allows us to group persons in a useful way for treatment. One approach to hearing aid fitting proposed that nine common audiometric categories of flat, sloping, and precipitous configurations constitute the great bulk of all those who are usually fitted with hearing aids (McCandless, Sjursen, & Preeves, 2000). The data summarized here categorize loss, similar to this approach, and show a large sample of adult hearing losses (based on the better ear) involving 1200 persons. This sample shows eight exclusive groups of hearing loss: two flat (*N* = 286), two sloping (*N* = 248), two precipitous (*N* = 304), and two groups with loss only at 4000 Hz (*N* = 362). In the past, the two 4000 Hz loss groups were not often fitted with hearing aids, but this is done more often in recent times because the use of open fit hearing aids has become much more common. These eight categories constitute the bulk of hearing losses usually encountered by an average audiologist, but only six show the classic flat, sloping, or precipitous patterns that are most often amplified. For these six, when we look at the configuration (shape) of the loss between 1000 and the average of 2000 and 4000 Hz, almost equal-sized groups show a flat pattern, a sloping pattern, and a precipitous pattern (see Figure 1.1).

Flat 1 = 248*	Sloping 1 = 199*	Precipitous 1 = 250*	Total *N* = 838*
Flat 2 = 38*	Sloping 2 = 49*	Precipitous 2 = 54*	(*Six categories)

See Figure 1.1 and the resource website, where the reader may enter better-ear thresholds on any client for 1000, 2000, and 4000 Hz to categorize the loss into an exclusive audiometric pattern.

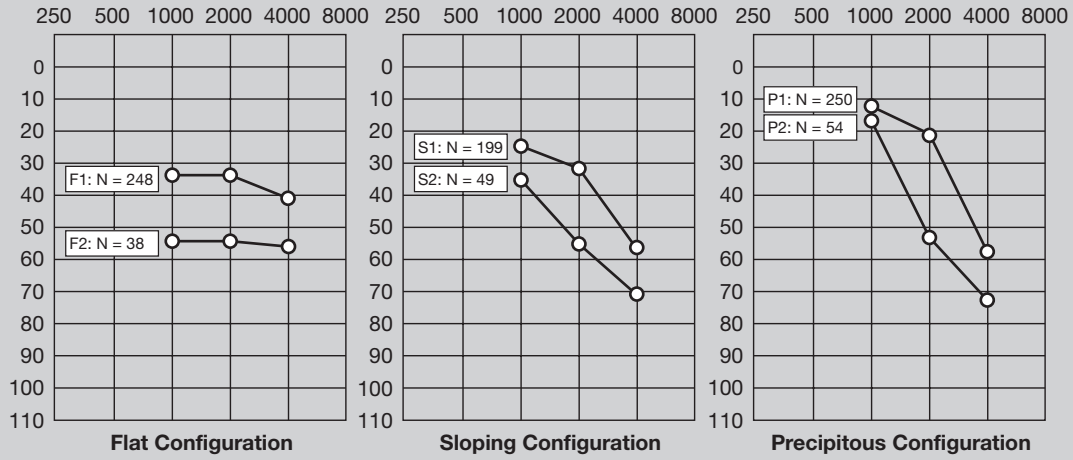

FIGURE 1.1 Six categories showing flat, sloping, and precipitous hearing configurations on 838 ears tested at health fairs.

Source: Based on Brockett and Schow (2001).

are included (Shepard, Davis, Gorga, & Stelmachowicz, 1981; see Chapter 9). Of these 3 million (2 million in school and 1 million younger), about 50,000 of school age are deaf (American Annals of the Deaf, 2005, 2011). As with children, most adults with hearing loss are considered to be hard of hearing, and only a small minority is deaf (Schow et al., 1996).

Degree (sensitivity), however, is only one of several important dimensions of a hearing loss. Even though it is often the first measure available and provides useful evidence of the impact of the loss, there are exceptions to this generalization. For example, some children with a profound loss of 90 dB HL outperform, in language and academic areas, average children who have a loss of only 70 dB HL.

Table 1.2 contains a description of deafness and hard of hearing categories in terms of typical hearing aspects, use of hearing, use of vision, language development, use of language, speech, and educational needs. Prevalence estimates are also shown.

Time of Onset

Most hard of hearing youngsters are thought to have hearing loss beginning early in life, but mild losses may not be detected, so prevalence data on young children are somewhat uncertain until school age (National Institute on Deafness and Other Communication Disorders, 2005). With youngsters who are deaf or have more severe hearing loss, the time when the loss is acquired and/or the progression of the loss will determine, in part, the extent to which normal speech and language will be present.

Cochlear implant recipients are increasingly avoiding the full effects from various kinds of deafness and are an exception to the general rule that sensorineural losses cannot be helped medically.

Severe hearing loss (deafness) may be divided into four categories (*prelingual*, *perilingual*, *postlingual*, *deafened*) depending on the person's age when the loss occurs (see Tables 1.2 and 1.3). *Prelingual deafness* refers to hearing loss present at birth or prior to the development of speech and language. The longer during the crucial language development years (up to age 5) that a person has normal hearing, the less chance there is that language development will be profoundly affected. This has led to a relatively new category of *perilingual deafness*, which has emerged to define the situation when deafness is acquired while developing a first language. *Postlingual deafness* means that loss occurs after about age 5; its overall effects are therefore usually less serious. However, even though language may be less affected, speech and education may be affected substantially (see Chapters 6 and 8). *Deafened* persons are those who lose hearing after their schooling is completed (i.e., sometime in their late teen years or thereafter). Normal speech, language, and education can be acquired by these individuals, but difficulty in verbal communication and other social, emotional, and vocational problems may occur (see Table 1.3). The more frequent use of cochlear implants renders these categories and time lines less useful than in the past. A child with prelingual deafness present at birth, if implanted within one year, will often function like a postlingually deaf child or even better and this is evidence that, as noted in Table 1.2, speech and language development are dependent on rehabilitation measures and amplification or access to audition. See more evidence of this in Chapters 6 and 8.

Type of Loss

Most hearing losses are classified as conductive, sensorineural, or mixed.

The type of loss may be *conductive* (damage in the outer or middle ear), *sensorineural* (hearing loss in the inner ear or nerve of hearing), or *mixed* (a combination of conductive and sensorineural). Generally, conductive losses are amenable to medical intervention, whereas sensorineural losses are aided primarily through audiologic rehabilitation. One of the main features of sensorineural loss is reduced speech recognition. In addition, those with severe and profound sensorineural loss may obtain a cochlear implant (see Chapter 3). These three types of loss are the major ones, but there are a few other types. Functional losses have no organic basis and thresholds are often eventually found to be within normal limits. Two other

TABLE 1.2 Categories and Characteristics of Hearing Loss

		CATEGORY OF DEAFNESS		
Characteristic	Hard of Hearing (31,000,000)[a]	Prelingual (115,000)[a]	Postlingual (230,000)[a]	Deafened (655,000)[a]
Hearing loss	*Sensitivity:* mild, moderate, or severe; *speech recognition:* fair to good (70–90%)	*Sensitivity:* severe or profound degree of loss; *speech recognition:* fair to poor		
Use (level) of hearing	Functional speech understanding (lead sense)	Functional signal warning and environmental awareness (hearing minimized)		
Use of vision	Increased dependence	Increased dependence		
Language and speech development	Dependent on rehabilitation measures (e.g., amplification, audition via cochlear implant)	Dependent on amplification/audition and early intervention	Dependent on amplification/audition and school rehabilitation	Normal
Use of language	May be affected	Almost always affected	May be affected	Usually not affected
Use of speech	May be affected	Almost always affected	Usually affected	May be affected/dependent on audition
Educational needs	Some special education	Considerable special education	Some special education	Education complete

[a]U.S. prevalence data for these categories, based on Schow et al. (1996) and Davis (1994), incidence figures and current U.S. census (www.census.gov/popclock) accessed February 24, 2017).