

Fundamentals of
AUDIOLOGY
FOR THE SPEECH-LANGUAGE PATHOLOGIST



Deborah R. Welling, AuD, CCC-A, FAAA

Associate Professor and Director of Clinical Education
Department of Speech-Language Pathology
Seton Hall University
South Orange, New Jersey

Carol A. Ukstins, MS, CCC-A, FAAA

Educational Audiologist
Newark Public Schools
Newark, New Jersey



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I dedicate this book to my mother, Regina, who had to maneuver, without a rudder, the waters of managing a child with hearing loss. To my sister, Barbara, who inspired me to pursue audiology. To my husband, Bill, for the days, months, and years of seeing me through this project. Thank you for your support.

—Deborah R. Welling

I dedicate this text to Dr. Susan Rezen, the person who taught me to love audiology, and to never say “Oops!” behind an audiometer. To my family: my husband, Jim, and my children, Nyasia, John, and Elizabeth, who have been a constant source of encouragement through the processes of this manuscript. To my mother, Joyce, who taught me that I could do anything.

—Carol A. Ukstins

Together, we dedicate this book to Dr. Annette Zaner, mentor and friend, who brought us together more than 20 years ago, never imagining that we would still be working together 20 years later.

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Foreword

Audiology and speech-language pathology are two professions that share a common bond—to prevent, identify, diagnose, and treat communication disorders. We work together so that persons with speech, language, swallowing, or hearing impairments can participate fully in society. Developed from a similar origin, the disciplines have evolved over the decades to become highly specialized fields that require those who enter each of these professions to achieve mastery of vast amounts of knowledge and significant skills. Yet there is substantial knowledge in each profession that is highly relevant to the other. Speech-language pathologists (SLPs) must understand the impact of hearing problems on the speech and language skills of their clients. Audiologists must consider the communication needs of their clients when assessing hearing and providing hearing rehabilitation services. In their daily work, SLPs focus on improving communication and swallowing whereas audiologists focus on hearing. Yet, these domains are so deeply interrelated that each discipline must be cognizant of a person's abilities in all of these areas in order to assist the person in the most effective manner. Regardless of the age, diagnosis, or ability level of a particular client, an SLP must always be knowledgeable about the individual's auditory abilities in order to make an appropriate diagnosis and design an effective treatment plan.

In this unique text, the authors have compiled information that is essential knowledge for both the student of speech-language pathology and the practicing clinician. For graduate students, this text will highlight the need to understand the risk of hearing loss in varied populations, the signs of hearing loss, and how disorders of audition impact our clients' abilities to either develop or maintain communication. For clinicians in the field, this text will serve as a valuable resource on the SLP's bookshelf, regardless of work setting. As a speech-language pathologist,

I've relied on the expertise of audiologists countless times throughout my career in my work with individuals with communication disorders. When I was working in early intervention, one of the first questions I asked parents who were concerned about their child's language development was about the results of any hearing testing. An audiological evaluation must be completed on any child suspected of a language or speech difficulty before a diagnosis can be made. On my caseload I had many children with Down syndrome who were at high risk for conductive hearing loss, so I worked very closely with an audiologist and otolaryngologist to ensure that these children could maximally benefit from their therapy programs. When I worked in home care with adults with aphasia, I often counseled these patients and their families about the value of using auditory amplification and the need for regular visits to the audiologist to monitor hearing status and troubleshoot problems with hearing aids. In my private practice, I worked closely with audiologists to help understand the auditory processing difficulties experienced by my pediatric clients with language disorders. I had many conversations with an audiology colleague on how to interpret the results of auditory processing assessments and how we could work together to make recommendations so that our clients could maximally benefit from their intervention programs. From these conversations, I also learned how to make classroom environments more "listener friendly" for all learners, not just those with language-learning difficulties.

Deborah Welling and Carol Ukstins have compiled information from experts in various segments of the field in order to provide the reader with a sound understanding of the principles of hearing development and disorders and the impact of these topics on speech-language pathology practice. Collaboration is a persistent theme that is seen throughout the text and refers not just to collaboration

between SLPs and audiologists, but among all members of healthcare and educational teams. The authors open the text with a discussion of a way to think about teaming, which is very pervasive in the literature right now—the concept of interprofessional collaboration. Welling and Ukstins and their contributing authors return to this topic consistently throughout the book and provide concrete examples of how SLPs can educate team members about hearing and communication.

The text is organized into three sections: first, the authors address the basics of sound and hearing to provide a firm foundation for the topics that follow; then issues related to assessment and identification of hearing impairment and rehabilitative strategies are discussed; and finally, topics related to hearing issues across the lifespan and in varied work settings are addressed. The text begins with fundamental information on the development of hearing and principles of auditory assessment, including understanding of key case history data useful for diagnosis and intervention planning. A variety of audiological tests are summarized in a style that communicates the type of information that is provided by each assessment and how to understand and apply the data obtained. The text then covers assistive technology both for children and adults and includes key information on laws, standards, and guidelines related to hearing and hearing loss for all work settings.

The final chapters provide an exhaustive treatment of hearing issues across the lifespan and provide information for clinical practice in all work settings. The section begins with a summary of hearing development and provides a detailed description of the role of hearing issues in the early intervention years. Clinicians working in school systems will find the chapter on audiology services in schools to be of great value. The text can serve as a resource for ensuring that all children are provided with optimal hearing conditions to support learning. The chapter on central auditory processing provides information to help the SLP wade through the confusing and sometimes conflicting information on identification and

management of this complex disorder. Those working with adults in a healthcare setting will find the information on management of hearing issues key to maximizing communication for their patients. Hearing loss occurs frequently in elderly populations and can be a central cause of a communication disorder or be an accompanying problem. SLPs will find very helpful, practical strategies advocated by the authors, including checklists and strategies for doing in-services in healthcare settings. In addition, the authors give beneficial suggestions for educating health professionals and family members about the impact of a hearing problem on a patient's daily life.

On a personal note, Dr. Deborah Welling has been helping me understand audiology since we were both graduate students at Queens College of the City University of New York several decades ago. I was enrolled in the speech-language pathology cohort and she was in the audiology cohort. Our groups spent little classroom time together, but we commiserated about our heavy workloads and how we struggled in our clinical practica. Dr. Welling and her audiology colleagues were so skilled in using the technical equipment in the audiology booth that my fellow SLP students and I relied on their expertise when we were enrolled in audiology clinic and trying to figure out how to conduct masking. I still have trouble interpreting all of those abbreviations on an audiogram, but I know I can continue to turn to her for advice. It's gratifying to see how her career has developed, and serendipitous that we are both colleagues once again, this time at Seton Hall University, across the river in New Jersey.

Theresa E. Bartolotta, PhD, CCC-SLP

Director of Assessment for Academic Affairs,
Office of the Provost

Associate Professor of Speech-Language
Pathology

Seton Hall University

South Orange, New Jersey

Introduction

Fundamentals of Audiology for the Speech-Language Pathologist is a manuscript forged as a true interdisciplinary text designed by a group of professionals with a sincere interest in training the speech-language pathologist in the essential components of audiology practices. For the student, it is our hope that this text provides a solid foundational understanding of the hearing mechanism, audiological equipment and procedures, and the diagnosis and (re)habilitation of hearing loss. For the practicing speech-language pathologist, *Fundamentals of Audiology for the Speech-Language Pathologist* should be viewed as a reference to use when seeking guidance in the management of hearing loss. It is not, however, intended to take the place of consulting one-on-one with colleagues in audiology, but rather to use as a tool to aid in asking the right questions. In order to maintain a text that is equal in both breadth and depth, much of the technical jargon used throughout the field of audiology has been replaced with easy-to-understand text providing the speech-language pathologist with an adequate understanding of audiometric concepts without getting bogged down in terminology.

When considering the demands of a career as a speech-language pathologist, your role in performing measures of hearing sensitivity or working with individuals with hearing loss may or may not have crossed your mind. However, both fall (within guidelines) under the scope

of practice as a speech-language pathologist. Clearly, then, in order to perform screening measures and interpret test data, a certain level of understanding must be achieved regarding a range of audiologic procedures and concepts. The purpose of this manuscript is not to convert the speech-language pathologist into an audiologist but rather to provide the professional with the necessary information, resource tools, and understanding to competently perform the roles and responsibilities as outlined in the scope of practice.

Through this clear presentation of audiometric measures and practices, it is our goal to provide the clinician with the resources in hand to properly assist in the service provision for patients of all ages with hearing loss so that through the therapeutic processes, families do not leave your office without a clear understanding of hearing loss; patients with hearing loss achieve the highest possible clinical/therapeutic outcomes; and, not one more child with hearing loss is misdiagnosed.

Fundamentals of Audiology for the Speech-Language Pathologist is your starting point on an exciting journey. From the basics of hearing science and anatomy of the ear, through the essential principles of evaluation, to the habilitation of infants and the rehabilitation of the elderly patient, at journey's end, you will find your reward: to make a difference in the lives of individuals with hearing loss.

About This Textbook

When considering the demands of a career as a speech-language pathologist, your role in performing measures of hearing sensitivity or working with individuals with hearing loss may or may not have crossed your mind. Further, as previously discussed, both fall (within guidelines) under the scope of practice as a speech-language pathologist. Clearly then, in order to perform screening measures and interpret audiometric test data, a certain level of understanding must be achieved regarding a range of audiologic procedures and concepts. The purpose of this text is not to convert the speech-language pathologist into an audiologist, but rather to provide the professional with the necessary information, resource tools, and understanding to competently perform the roles and responsibilities. To that end, this text will address the concepts of hearing evaluation, hearing loss, technology, and rehabilitation as they pertain specifically to your needs as a communication disorders service provider. The extensive underlying mathematical and neurological processes related to the evaluation of hearing is best left to the practicing audiologist. However, you are always encouraged to research further into a concept should your specific practices necessitate such knowledge.

In order to facilitate a clear understanding of the necessary elements of audiology, the reader will find the following headings throughout much of this text as discussion of testing procedures and practices unfolds. The goal of each section is described as follows.

What You Need To Know

This section contains a basic overview of the particular procedure, some of the key terminology used, and a more general answer to the question “why do we do this?”. Excessive technological information detail is not discussed.

How It Works

This section provides more specific information regarding the procedure and what it is, a discussion of objective versus subjective measures, and the yield of the procedure. In some cases, the materials used are also referenced.

Technically Speaking

This section provides a more in-depth technical, anatomical, and/or physiological basis for each particular area discussed. Additional depth and detail are added for those with a keen interest in the particular topic.

Methodologies

Very simply, this section explains the process and/or procedures by which the examiner obtains the data derived, including testing instructions and steps taken for obtaining such data. As appropriate, this section also contains information regarding how the results of the given test or procedure fits in with the larger test battery.



Acknowledgments

We would like to thank those professionals who assisted in the creation of this text. Without the efforts of the following individuals, we would not have realized our goal to create a text that exemplifies a true collaborative effort. It is with gratitude that we recognize Karen Kushla, Donna Merchant, Arsen Zartarian, Christina Perigoe, Marietta Paterson, Nancy Schneider, Cheryl DeConde Johnson, Ralph Moscarella, Tena McNamara, and Annette Hurley. We extend our sincere appreciation to our colleagues

Nina Capone Singleton and Natalie Neubauer for their expertise and input throughout this project. We would also like to thank Amanda Russo and Mary Carlson for their tireless energy and efforts. May the knowledge you have gained assist you in becoming great professionals. Finally, we would like to recognize Neil Bauman, Curator of The Hearing Aid Museum, not only for his contribution to this text, but for his efforts to keep a portion of audiology history alive for generations to come.

About the Authors

Deborah R. Welling, AuD, CCC-A, FAAA is an associate professor and director of clinical education in the Department of Speech-Language Pathology at Seton Hall University. Dr. Welling earned her bachelor of arts degree in communication arts and sciences from Hofstra University, her master's degree in audiology from Queens College of the City University of New York, and her doctoral degree in audiology from the University of Florida.

Dr. Welling is a member of the American Speech-Language-Hearing Association (ASHA); a fellow of the American Academy of Audiology (AAA); and a member of the New Jersey Speech-Language-Hearing Association (NJSHA), for whom she has served as Vice-Chair of the Higher Education Committee.

Prior to her role as an associate professor and director of clinical education, Dr. Welling spent many years in direct clinical service provision and supervision, with extensive experience in the behavioral assessment of the very young and difficult-to-test populations. It was during this time period that she met her coauthor, Carol Ukstins.

Dr. Welling has also had extensive involvement with interdisciplinary screening and evaluation processes in the early intervention, preschool, and school-aged populations, with an emphasis on (central) auditory processing assessment.

Since joining the faculty at Seton Hall University, Dr. Welling has been teaching undergraduate and graduate-level courses that cover anatomy and physiology of the

auditory system, fundamentals of sound (acoustics), basic and advanced audiologic measurement and interpretation, and aural habilitation and rehabilitation. In addition, she provides clinical and academic advising and mentoring for undergraduate- and graduate-level students.

Carol A. Ukstins, MS, CCC-A, FAAA is an educational audiologist who is currently serving as the Auditory Impairments Program Specialist for The Newark Public Schools, the largest school system in the State of New Jersey. She holds a bachelor's degree in communication sciences and disorders from Worcester State College (1987), a master's degree in audiology from Syracuse University (1989), and advanced certification in assistive technology (2010). She is a member of the American Speech-Language-Hearing (ASHA) association and a fellow of the American Academy of Audiology (AAA).

With more than 20 years of experience in audiology, she has worked in hospital and community healthcare centers. Alongside her coauthor, Deborah Welling, she has worked extensively with a wide range of difficult-to-test populations including the very young and those with multiple disabilities.

She currently works in the public school sector with Deaf and hard of hearing students, providing support throughout the district to students with both hearing impairment and central auditory processing deficits. The parent of two children with hearing loss; she speaks with both professional and personal knowledge on the impact of hearing loss.

Contributors

Annette Hurley, PhD, CCC-A

Associate Professor
Department of Communication Disorders
LSU Health Sciences Center
New Orleans, Louisiana

Cheryl DeConde Johnson, EdD, FAAA

Board Certified in Audiology with Pediatric Audiology
Specialty Certification
The ADEvantage Consulting
Adjunct Assistant Professor
University of Arizona
Tucson, Arizona

Karen J. Kushla, ScD, CCC-A/FAAA

Adjunct Professor
School of Communication Disorders and Deafness
Kean University
Union, New Jersey

Tena L. McNamara, AuD, CCC-A/SLP

Assistant Professor
Department of Communication Disorders
and Sciences
Eastern Illinois University
Charleston, Illinois

Donna M. Goione Merchant, AuD, CCC, FAAA

NJ Certified Teacher of the Deaf/Hearing Impaired
NJ Certified Teacher of the Handicapped
Private Practice Audiologist
Assistant Professor
Montclair State University
Montclair, New Jersey

Ralph Moscarella, MA, CCC-A, FAAA

Educational Audiologist
Newark Public Schools
Newark, New Jersey
Audiologist-Private Practice
Audiology Associates of Freehold
Freehold, New Jersey

Marietta M. Paterson, EdD, CED

Director, Education of the Deaf
Associate Professor
Department of Speech and Hearing Sciences
The University of Southern Mississippi
Hattiesburg, Mississippi

Christina Barris Perigoe, PhD, CED, CCC-SLP, LSLS-Cert. AVT

Coordinator
Graduate Program in Early Oral Intervention
Associate Professor
Department of Speech and Hearing Sciences
The University of Southern Mississippi
Hattiesburg, Mississippi

Nancy G. Schneider, MA, CCC-A, FAAA

Audiologist
Little Falls, New Jersey

Arsen Zartarian, Esq.

President
New Jersey Association of School Attorneys
Deputy General Counsel
The Newark Public Schools
Newark, New Jersey

Reviewers

Vishwa Bhat, PhD, CCC-A, F-AAA

Associate Professor
Department of Communication Disorders and Sciences
William Paterson University
Wayne, New Jersey

Rieko M. Darling, PhD, FAAA, CAAA

Associate Professor of Audiology
Department of Communication Sciences and Disorders
Western Washington University
Bellingham, Washington

Dean Mancuso, AuD

Assistant Professor of Audiology
Department of Otolaryngology / Head and Neck Surgery
Columbia University Medical Center
New York City, New York

Anne D. Olson, PhD

Associate Professor
Department of Communication Sciences and Disorders
University of Kentucky
Lexington, Kentucky

Donna Pitts, AuD, CCC-A

Assistant Professor
Department of Speech-Language Pathology
Loyola University Maryland
Baltimore, Maryland

