If you are viewing this course as a recorded course after the live webinar, you can use the scroll bar at the bottom of the player window to pause and navigate the course.

This handout is for reference only. It may not include content identical to the powerpoint. Any links included in the handout are current at the time of the live webinar, but are subject to change and may not be current at a later date.

Rethinking Your Diagnostic Audiology Battery: Part 1. Using Value Added Tests

James W. Hall III, Ph.D.

Professor
Salus University and University of Hawaii

Adjunct or Visiting Professor
Northwestern University, American University of Beirut, University of Nebraska-Lincoln, University of Florida, Nova Southeastern University

Extraordinary Professor
University of Pretoria South Africa

jwhall3phd@gmail.com *www.audiologyworld.net*

Rethinking Your Diagnostic Audiology Battery: Part 1. Using Value Added Tests

- **Learner Outcomes**
  1. **Describe evolution of the audiological test battery**
  2. **Define what is meant by "standard of care", "evidence based practice" and "value added test"**
  3. **List advantages of specific test procedures in assessing auditory functions**

Rethinking Your Diagnostic Audiology Battery: Part 1. Using Value Added Tests

- ❑ **Historical Perspective on Diagnostic Audiology** ***(0—5 min)***
- ❑ **Standard of Care in Audiology** ***(6—10 min)***
- ❑ **Concept of Value Added Tests** ***(11—15 min)***
- ❑ **Guidelines for Efficient and Effective Diagnostic Test Batteries** ***(41—55 min)***
- ❑ **Summary, Questions and Answers** ***(55—60 min)***

Scientific Foundation of Audiology

Psychoacoustics Laboratory (PAL)
Harvard University (1940s and 1950s)

SS Stevens
(1906-1973)

Scientific Foundations of Audiology
Audiology Grandparents

Georg von Bekesy
(1899 - 1972)

Nobel Prize for
Physiology or Medicine 1961

GSI E800
Bekesy Audiometer

Scientific Foundations of Audiology
Audiology Grandparents

PhD from University of Chicago under Nobel Prize Winner Robert Miliken

Illustrious Career at Bell Telephone Laboratories

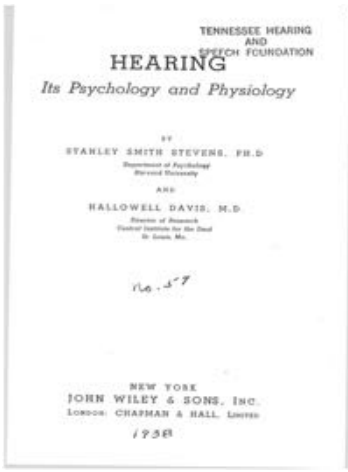
Seminal Publications, e.g.

Fletcher H (1929). Speech and Hearing. New York: D Van Nostrand

Fletcher H & Steinberg JC (1929). Articulation testing methods. Bell System Technical Journal, 8, 806-854

Harvey Fletcher
(1884-1981)

Scientific Foundations of Audiology
Audiology Grandparents


TENNESSEE HEARING AND SPEECH FOUNDATION

HEARING

Its Psychology and Physiology

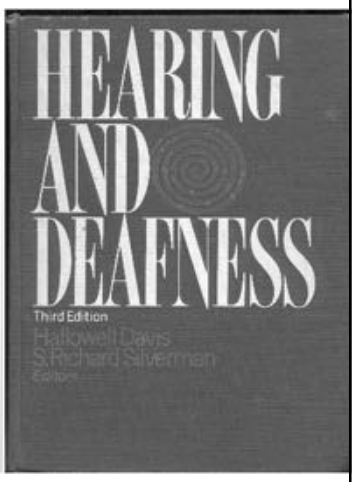
BY

STANLEY SMITH STEVENS, PH.D

AND

HALLOWELL DAVIS, M.D

NEW YORK
JOHN WILEY & SONS, INC.
LONDON: CHAPMAN & HALL, LIMITED
1938



Hallowell Davis
(1896 - 1992)

Scientific Foundations of Audiology
Audiology Grandparents


THE MEASUREMENT
OF HEARING

IRA J. HIRSH, *Central Institute for the Deaf and Washington University, St. Louis, Missouri; formerly Research Fellow, Psycho-Acoustic Laboratory, Harvard University*

McGRAW-HILL BOOK COMPANY, INC.
1952 NEW YORK TORONTO LONDON

9/65

LIBRARY

Ira Hirsh
(1922 - 2010)

Scientific Foundations of Audiology

Audiology Grandparents

The Hearing Journal, 64 (8), 2011

Robert Galambos, PhD, MD
(1914 - 2010)

Origins of Audiology in the USA

Demand for Hearing Services During and After WW II

Raymond Carhart: Father of Audiology
Developed Audiology Test Battery 70 Years Ago
(Audiology Father of James Jerger)

- **Test battery at the beginning of our profession, in order of test administration**
  - **Air-conduction pure tone audiometry**
  - **Bone-conduction pure tone audiometry**
  - **Speech reception thresholds**
  - **Word recognition (PB word lists)**
  - **Uncomfortable loudness level (UCL), i.e., loudness discomfort level (LDL)**

Source: Wiener F & Miller G. Hearing aids. In Combat Instruments II. Washington, D.C. NDRC Report 117, 216-232, 1946

Raymond Carhart

Scientific Foundation of Audiology
James Jerger, PhD … My Audiology Father
Father of Diagnostic Audiology; Founder of American Academy of Audiology

Rethinking Your Diagnostic Audiology Battery: *An Update or "Makeover" is Long Overdue*

Procedure	% Performing Procedure
Pure tone audiometry: air conduction	100%
Pure tone audiometry: bone conduction	100%
Word recognition	95%
Speech reception threshold	91%
UCL (LDL) for speech	83%
Tympanometry	45%
UCL (LDL) for tones	45%
Acoustic reflexes	20%
Otoacoustic emissions (OAEs)	4%

Source: The Hearing Journal, December, 2002

Rethinking Your Diagnostic Audiology Battery: Part 1. Using Value Added Tests

- ❑ Historical Perspective on Diagnostic Audiology *(0—5 min)*
- ❑ Standard of Care in Audiology *(6—10 min)*
- ❑ Concept of Value Added Tests *(11—15 min)*
- ❑ Guidelines for Efficient and Effective Diagnostic Test Batteries *(41—55 min)*
- ❑ Summary, Questions and Answers *(55—60 min)*

Standard of Care in Audiology:
Best Practice is Research Based Practice

"Those who fall in love with practice without science are like a sailor who steers a ship without a rudder or compass, and who can never be certain whither he is going."

Leonardo Da Vinci (1452-1519)

Evidence-Based Practice:
Categories of Research Evidence (ASHA, 2004)

- **1a: Well-designed meta-analysis of randomized controlled trials**
- **1b: Well-designed randomized controlled trials**
- **2a: Well-designed controlled studies without randomization**
- **2b: Well-designed quasi-experimental studies**
- **3: Well-designed non-experimental studies, i.e., correlational and case studies**
- **4: Expert committee reports, consensus conferences and clinical experience**

Rethinking Your Diagnostic Audiology Battery: Part 1. Using Value Added Tests
Standard of Care

- ❑ The degree of caution that a reasonable person should exercise in a given situation so as to avoid causing injury … try to help but do not harm
- ❑ Consistent with local, regional or national clinical practice
- ❑ Follows guidelines on clinical practice approved by
  - Multi-disciplinary professional committees or panels, e.g., Joint Committee on Infant Hearing
  - National professional organizations
- ❑ Is consistent with statements of
  - Scope of Practice
  - Code of Ethics
- ❑ In compliance with Federal guidelines for clinical practice

Rethinking Your Diagnostic Audiology Battery: Part 1. Using Value Added Tests

- ❑ Historical Perspective on Diagnostic Audiology *(0—5 min)*
- ❑ Standard of Care in Audiology *(6—10 min)*
- ❑ Concept of Value Added Tests *(11—15 min)*
- ❑ Guidelines for Efficient and Effective Diagnostic Test Batteries *(41—55 min)*
- ❑ Summary, Questions and Answers *(55—60 min)*

The Concept of Value Added Tests (VATs): *Rationale for Inclusion in a Test Battery*

- Procedure adds value to the description of auditory status for the patient, including information that is:
  - Not available from other procedures and/or
  - Obtained quicker than with another procedure and/or
  - Poses less risk than an alternative procedure and/or
  - Costs less than a comparable procedure
  - Findings are more reliable or valid than an alternative test
  - Highly sensitive to auditory dysfunction
  - Provides site-specific information on auditory dysfunction
  - Contributes to more accurate diagnosis
  - Useful in managing the patient and/or
  - Information leads to better outcome for the patient

The Concept of Value Added Tests (VATs): *Old versus New Procedures*

- Some old procedures almost always add value, e.g.,
  - Tympanometry
  - Acoustic reflexes
- Some more recent procedures almost always add value, e.g.,
  - Otoacoustic emissions
- Some traditional test procedures do *not* invariably add value, e.g.,
  - Speech recognition threshold (SRT)
  - Bone conduction pure tone audiometry
  - Word recognition in quiet at 40 dB SL

The Concept of Value Added Tests (VATs): A Critical Look at Three Traditional Procedures *Speech Recognition Threshold (SRT)*

- ❑ Study of 1000 pediatric and adult patients (Roscher & Hall, 2005)
- ❑ SRT rarely contributed to diagnosis of hearing loss
- ❑ Factors in significant differences between PTA vs. SRT
  - ● Age
    - ✓ Children (< 20 years)
    - ✓ Older adults (> 66 years)
  - ● Hearing loss
    - ✓ No value in persons with normal hearing thresholds
    - ✓ Greater PTA-SRT difference for SNHL
    - ✓ Greater PTA-SRT difference for sloping hearing loss

The Concept of Value Added Tests (VATs): A Critical Look at Three Traditional Procedures *Speech Recognition Threshold (SRT)*

TABLE 2. Age distribution for all complete records and for patients with repeat tests excluded

	Age											
	<10	10s	20s	30s	40s	50s	60s	70s	80s	90s	No age	Total
All records												
N	2461	2535	1810	2607	2850	2674	2522	2222	942	57	3118	23798
%	10	11	8	11	12	11	11	9	4	0	13	100
Patients												
N	1443	1368	1396	1877	2051	1920	1794	1527	679	36	2727	16818
%	9	8	8	11	12	11	11	9	4	0	16	100

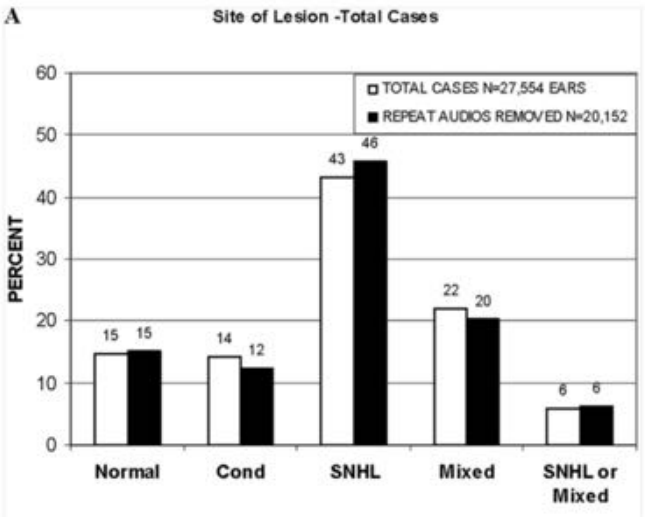
Margolis RH & Saly GL (2008). Distribution of hearing loss characteristics in a clinical population. *Ear & Hearing, 29*, 524-532

For 53% of 16,818 patients, age was between 20 to 70 years.

The Concept of Value Added Tests:
Selective Use of Speech Reception Threshold

- Little or no value for
  - Adult patients age 20 to 65 years
  - Patients with normal hearing thresholds
  - Consistent findings available before pure tone audiometry
    - ✓Normal tympanograms bilaterally
    - ✓Acoustic reflex thresholds at expected normal levels
    - ✓Otoacoustic emission amplitudes within normal limits
- Speech reception threshold measurement in such patients will
    - ✓Waste valuable test time
    - ✓Not add value to the diagnosis
    - ✓Not add value to referral or management decisions
    - ✓Not lead to improved patient outcome

The Concept of Value Added Tests (VATs):
A Critical Look at Three Traditional Procedures
Bone Conduction Pure Tone Audiometry



Margolis RH & Saly GL (2008). Distribution of hearing loss characteristics in a clinical population. *Ear & Hearing, 29*, 524-532

The Concept of Value Added Tests:
Selective Use of Bone Conduction Pure Tone Audiometry

- ❑ No value in many patients, e.g., an adult with
  - ● No history of middle ear disease
  - ● Pattern of findings available before pure tone audiometry
    - ✓ Normal tympanograms bilaterally
    - ✓ Acoustic reflex thresholds at expected normal levels
    - ✓ Otoacoustic emission amplitudes within normal limits
  - ● Air conduction pure tone audiometry showing sloping high frequency hearing loss
- ❑ Bone conduction pure tone audiometry in such patients will
  - ✓ Waste valuable test time
  - ✓ Not add value to the diagnosis
  - ✓ Not add value to referral or management decisions
  - ✓ Not lead to improved patient outcome

The Concept of Value Added Tests (VATs):
Selective Use of Word Recognition in Quiet

- ❑ Patient is an adult with the chief complaint of difficulty hearing in noisy settings
- ❑ Patient converses easily in the clinic without visual cues
- ❑ Pure tone audiometry findings are entirely normal
- ❑ Word recognition in quiet will …
  - ● Waste valuable test time
  - ● Not add value to the diagnosis
  - ● Not add value to management
  - ● Not lead to improved patient outcome
- ❑ Instead
  - ● Perform a test of speech perception in noise
  - ● Consider other tests of auditory processing

Rethinking Your Diagnostic Audiology Battery: Part 1. Using Value Added Tests

- ❑ Historical Perspective on Diagnostic Audiology *(0—5 min)*
- ❑ Standard of Care in Audiology *(6—10 min)*
- ❑ Concept of Value Added Tests *(11—15 min)*
- ❑ Guidelines for Efficient and Effective Diagnostic Test Batteries *(41—55 min)*
- ❑ Summary, Questions and Answers *(55—60 min)*

Rethinking Your Diagnostic Audiology Battery: Part 1. Using Value Added Tests

Comparative Times for Different Tests

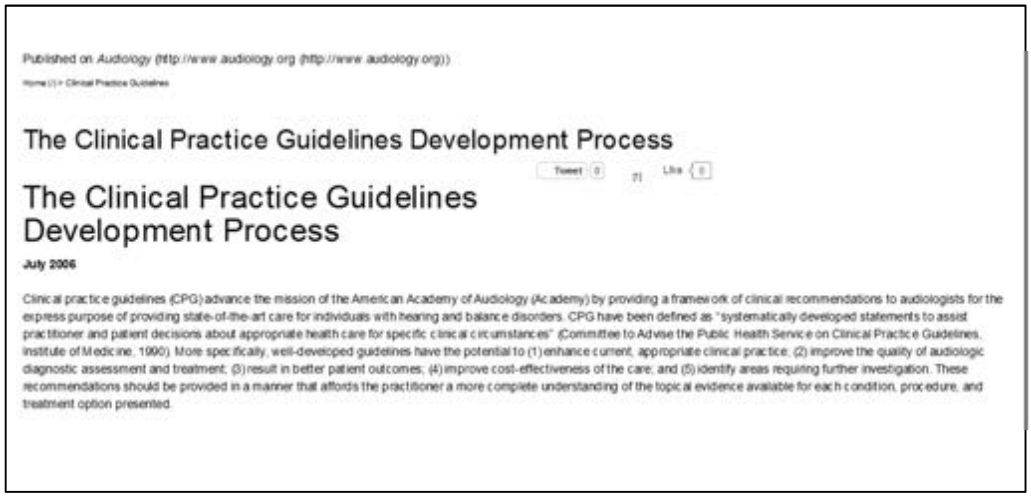
"Remember that time is money"

Benjamin Franklin

Advice to a Young Tradesman

1748

American Academy of Audiology Clinical Guidelines Development



Published on *Audiology* (http://www.audiology.org (http://www.audiology.org))

Home (1) > Clinical Practice Guidelines

The Clinical Practice Guidelines Development Process

Tweet 0 71 Like 0

The Clinical Practice Guidelines Development Process

July 2006

Clinical practice guidelines (CPG) advance the mission of the American Academy of Audiology (Academy) by providing a framework of clinical recommendations to audiologists for the express purpose of providing state-of-the-art care for individuals with hearing and balance disorders. CPG have been defined as "systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances" (Committee to Advise the Public Health Service on Clinical Practice Guidelines, Institute of Medicine, 1990). More specifically, well-developed guidelines have the potential to (1) enhance current, appropriate clinical practice; (2) improve the quality of audiologic diagnostic assessment and treatment; (3) result in better patient outcomes; (4) improve cost-effectiveness of the care; and (5) identify areas requiring further investigation. These recommendations should be provided in a manner that affords the practitioner a more complete understanding of the topical evidence available for each condition, procedure, and treatment option presented.

Examples of Current AAA Practice Guidelines in Audiology *(More are Coming)*

- **2007 Joint Committee on Infant Hearing (JCIH) Position Statement**
- **2008 Guidelines on Identification, Diagnosis, and Management of Auditory Neuropathy Spectrum Disorder in Infants and Young Children**
- **2009 Clinical Guidelines for Ototoxicity Assessment and Monitoring**
- **2010 American Academy of Audiology Clinical Practice Guidelines: Diagnosis, Treatment, and Management of Children and Adults with Central Auditory Processing Disorders**

Examples of Current AAA Practice Guidelines in Audiology *(More are Coming)*

- 2010 American Academy of Audiology Clinical Practice Guidelines: Childhood Hearing Screening
- 2012 American Academy of Audiology: Audiologic Guidelines for the Assessment of Hearing in Infants and Young Children
- 2013 American Academy of Audiology Clinical Practice Guidelines: Pediatric Amplification
- American Academy of Audiology Clinical Practice Guidelines: Otoacoustic Emissions (in progress)

Examples of Some of the ASHA Audiology Guidelines *(www.asha.org)*

- Audiologic Screening (1997)
- Audiology Service Delivery in Nursing Homes (1997)
- Fitting and Monitoring FM Systems (2002)
- Audiology Service Provision in and for Schools (2002)
- Clinical Practice Guidelines: Cerumen Impaction (2008)
- Clinical Practice Guidelines: Benign Paroxysmal Positional Vertigo (2008)
- Audiologists Providing Informational and Adjustment Counseling (2008)

Examples of Current Practice Guidelines in Audiology: *UK*

Recommended Procedure

Tympanometry

Date: August 2013

Recommended Procedure

Pure-tone air-conduction and bone-conduction threshold audiometry with and without masking

Date: September 2011 [Minor amendments: February 2012, and December 2015]

Position Statement

Auditory Processing Disorder (APD)

Date of this version: March 2011

Examples of Current Practice Guidelines in Audiology: *UK*

NHS
Antenatal and Newborn Screening Programmes

NEWBORN HEARING SCREENING AND ASSESSMENT

Guidance for Auditory Brainstem Response testing in babies

Version 2.1

March 2013

NHSP Clinical Group

Graham Sutton[1], Guy Lightfoot[2] (Co-editors)
Contributors: John Stevens[3], Rachel Booth[4], Siobhan Brennan[5], Rachel Feirn[6], Rhys Meredith[7]

NHS
Screening Programmes

NEWBORN HEARING SCREENING AND ASSESSMENT

Guidelines for the Assessment and Management of Auditory Neuropathy Spectrum Disorder in Young Infants

Version 2.2

August 2013

NHSP Clinical Group

Rachel Feirn[1] (Editor), Graham Sutton[2], Glynnis Parker[3], Tony Sirimanna[4], Guy Lightfoot[5], Sally Wood[2]

Examples of Current Practice Guidelines in Audiology: *UK*

Recommended Procedure

Taking an aural impression

Date: February 2013

Recommended Procedure (Supplement)

Taking an aural impression: children under 5 years of age

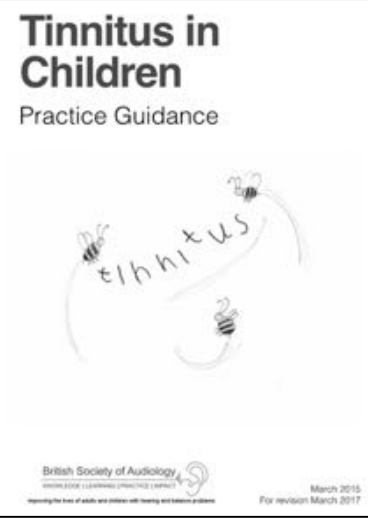
Date: February 2013

Examples of Current Practice Guidelines in Audiology: *UK*

Recommended Procedure

Cortical Auditory Evoked Potential (CAEP) Testing

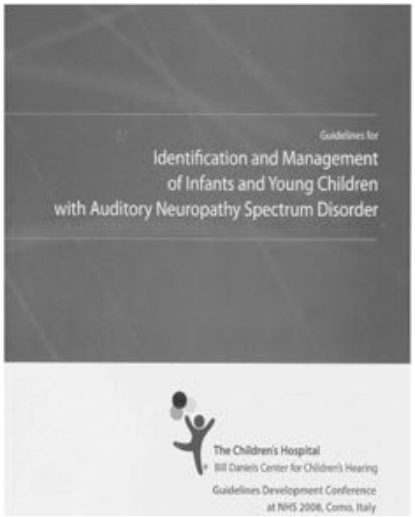
Date: May 2016



Canadian Clinical Guidelines on Auditory Processing Disorder in Children and Adults *(www.sac-oac.ca)*

Clinical Guidelines: Auditory Neuropathy Spectrum Disorder (2010)

- In June 2008, at the invitation of Deborah Hayes, a panel of experts met in Como, Italy at the NHS 2008 Conference to develop Guidelines for the Identification and Management of Infants and Young Children with Auditory Neuropathy.
- The panel consisted of:
  - Yvonne Sininger, Ph.D.
  - Arnold Starr, M.D.
  - Christine Petit, M.D., Ph.D.
  - Gary Rance, Ph.D.
  - Barbara Cone, Ph.D.
  - Kai Uus, M.D., Ph.D.
  - Patricia Roush, Au.D.
  - Jon Shallop, Ph.D.
  - Charles Berlin, Ph.D.



A Modern Diagnostic Audiologic Test Battery
In the Order of Testing for New Patients
Total Test Time ~ 30 - 45 minutes.

- ❑ Otoscopy
- ❑ Objective measures
  - ● Otoacoustic emissions (OAEs)
    - ✓ DPOAEs 500 to 8000 Hz
    - ✓ Normal versus present but abnormal versus absent
  - ● Aural immittance measures
    - ✓ Tympanometry
    - ✓ Acoustic reflexes (*crossed vs. uncrossed conditions)*

A Modern Diagnostic Audiologic Test Battery
In the Order of Testing for New Patients.
Total Test Time ~ 30 - 45 minutes.

- ❑ Behavioral measures
  - ● Pure tone audiometry *(automated technique as appropriate)*
    - ✓ Inter-octave frequencies (e.g., 3000 and 6000 Hz)
    - ✓ High frequency (> 8000 Hz) audiometry *as indicated*
    - ✓ Bone conduction measurement *only as indicated*
  - ● Speech audiometry
    - ✓ SRT *only as indicated*
    - ✓ Word recognition (recorded material) with 10 most difficult words first
    - ✓ Speech-in-noise test
    - ✓ Screen auditory processing as indicated

Rethinking Your Diagnostic Audiology Battery: Part 1. Using Value Added Tests

- ❑ Historical Perspective on Diagnostic Audiology *(0—5 min)*
- ❑ Standard of Care in Audiology *(6—10 min)*
- ❑ Concept of Value Added Tests *(11—15 min)*
- ❑ Guidelines for Efficient and Effective Diagnostic Test Batteries *(41—55 min)*
- ❑ Summary, Questions and Answers *(55—60 min)*

Rethinking Your Diagnostic Audiology Battery: Part 1. Using Value Added Tests

- ❑ Summary
  - Audiology patient care should be in compliance with clinical practice guidelines
  - Efficiency and effectiveness should also be considered in the diagnostic audiology test battery … the most clinical information in the least test time
  - The test battery should consist of value added tests … how will the findings contribute to diagnosis or management of the patient
- ❑ Questions and Answers