CDS 484/529 Aural Rehabilitation
PREVALENCE OF HEARING LOSS IN CHILDREN

• HL is one of the most common birth anomalies
  • Incidence: 1 to 6 per 1,000 babies (Kemper & Downs 2000; Cunningham and Cox 2003)

• About 20% of these children have a profound HL

• About 3% more will develop HL after birth

• 738,000 individuals in U.S. have severe to profound HL
  • Of these, almost 8% are under the age of 18 (Blanchfield, et. al. 2001)

• There is low awareness among professionals regarding:
  • prevalence and the need for HL screening and assessment
  • and rehab options for deaf and hard-of-hearing children
IDENTIFICATION AND QUANTIFICATION OF HEARING LOSS

• Hearing screening objective tests:
  • ABR
  • OAE

• Behavioral tests:
  • Visual reinforcement audiometry
  • Conditioned play audiometry
  • Standard hearing tests
CONDITIONED PLAY AUDIOMETRY (CPA)
(COGNITIVE AGE 2 - 5)

https://www.youtube.com/watch?v=_eKn-lrGYZo
VISUAL REINFORCEMENT AUDIOMETRY (VRA)
(AGES 6 MONTHS — 2 YEARS)

https://www.youtube.com/watch?v=LK5ExH4KwBI
THE PRIMARY GOAL OF AURAL REHAB FOR CHILDREN

• To facilitate speech and language acquisition
  • Factors that affect speech & language acquisition:
    • The severity of hearing loss
    • The level of the rehab service received
FEDERAL LAW ENSURING SPECIAL EDUCATION FOR CHILDREN WITH DISABILITIES

- Individuals with Disabilities Education Act (IDEA)
  - Previously known as PL 94-142
  - First enacted in 1975
  - Needs to be reauthorized every few years.
• Ensures students with a disability are provided a Free Appropriate Public Education (FAPE) in the Least Restrictive Environment (LRE)
  
  • **IDEA Part B:**
    • Guaranteed to children with disabilities age 3 to 21 and their families
    • The services to be provided should be detailed in an Individualized Education Program (IEP) that is tailored to individual needs
  
• Ensures infants and toddlers with a disability are provided with early intervention services in Natural Environments
  
  • **IDEA Part C:**
    • Guaranteed to children with disabilities age birth through 2 and their families
    • The services to be provided should be detailed in an Individual Family Service Plan (IFSP) that is tailored to individual needs.
    • At the age of 3, the child is transitioned to IDEA Part B and then receives an IEP
LEAST RESTRICTIVE ENVIRONMENT (LRE)

• No clear definition

• Generally includes educating children with disabilities in a local public school among children without disabilities

• Factors that need to be considered in determining LRE:
  • Communication needs (preferred modes of communication)
  • Severity of the hearing loss and potential for using residual hearing
  • Academic level of individual
  • Social, emotional and cultural needs
RELATED SERVICES FOR EDUCATION OF CHILDREN WITH HEARING LOSS

- Audiology
- Speech-language pathology
- Early identification team
- Psychology
- Physical and occupational therapy
- School health
- Assessment of disabilities team
- Recreation
- Social work
- Parent counseling and training
- Transportation
EDUCATION SETTINGS

Regular Education with In-class Support

Part-time Special Education: Resource Room

Full-time Special Education: Separate Facility

Full-time Regular Education

Regular Education with Pull-out Support

Full-time Special Education: Separate Class

Residential School

FIGURE 8.1
Continuum of educational placements.
COMMUNICATION APPROACHES

• **Listening and Spoken Language**
  • Emphasizes the use of residual hearing
  • Full-time use of amplification (HAs and CIs)

• **Oral-aural approach**
  • The use of visual cues (e.g., speechreading) is often encouraged

• **Auditory-verbal approach**
  • The use of auditory skills instead of visual cues are emphasized
  • Visual cues such as speechreading are explicitly discouraged
COMMUNICATION APPROACHES

- **Manual-Visual Systems: Using sign only**
  - In U.S. this would include **ASL or SEE**
  - Internationally, there are many others:
    - British Sign Language (BSL)
    - Spanish Sign Language (LSE or *Lengua de Signos Españoles*)
    - Mexican sign Language (LSM or *Lengua de Señas Mexicana*)
    - Russian Sign Language (РЖЯ or Русский Жестовый Язык)
    - Chinese Sign Language (CSL or 中国手语)
COMMUNICATION APPROACHES

• **Total communication**
  • As outlined in the Schow and Nerbonne text, the definition of Total Communication is too narrow
    • More broadly, this communication approach emphasizes the use of *any* and *all* methods of communication available to the communicating participants, including…
      • ASL, SEE, fingerspelling
      • Natural gestures (and other kinemic strategies)
      • Residual hearing (with use of HAs, CIs, etc.)
      • Speech
      • Lipreading
      • Others
      • Combinations of the above techniques may be very informal, or…
      • Formal, such as Cued Speech

• **Bilingualism/Multilingualism**
SERVICE DELIVERY SYSTEMS

• Depends on:
  • The child’s age
  • The severity of the hearing loss
  • The presence of other participation restricting (i.e., handicapping) conditions

• Three stages:
  1. Early intervention: 0-3 y
  2. Preschool years: 3-5 y
  3. Regular school years: 5-21 y
1. THE PROCESS OF EARLY INTERVENTION

- Referral – unless parent objects
- Initial Service Coordinator
- Evaluation to determine EI eligibility – with parents’ consent
- Individual Family Service Plan (IFSP) Meeting – if child is eligible
- Early Intervention Services
- IFSP:
  - Reviewed every 6 months
  - Evaluated annually
- Transition to IDEA Part B at age 3
INDIVIDUALIZED FAMILY SERVICE PLAN (IFSP)

- Developed by speech pathologist, audiologist, pediatrician, psychologist, physical therapist, occupational therapist, the parents, and others as needed

- The major items that are included in an IFSP:
  - The child's current levels of development
  - The family's concerns, priorities, and resources
  - Expected outcomes to be achieved for the child and family
  - The specific early intervention services to be provided
  - A transition plan to appropriate preschool services upon reaching age three
Early Intervention is a family-centered program

- An emphasis on family support as a primary intervention goal
- Families have a decision-making authority
- Families are the primary interventionist
- Providing sites for services: in the home or a routinely-accessed community setting
2. THE PRESCHOOL PROGRAM

• Provides services to children with disabilities at the ages of 3 to 5.
• Funded by the child’s school district
• Governed by Committee on Preschool Special Education (CPSE)
  • Audiologists and SLPs frequently (but not always) asked for input when formulating IEP for child with hearing loss
3. THE REGULAR SCHOOL PROGRAM

- Provides services to individuals with disabilities ages of 5-21.
- Funded by the child’s school district
- Services are provided until the student obtains a Regents or local high school diploma, or until the student ages out at 21, whichever comes first
- Governed by Committee on Special Education (CSE)
  - Audiologists and SLPs frequently (but not always) asked for input when formulating IEP for child with hearing loss
INDIVIDUALIZED EDUCATION PROGRAM (IEP)

- Developed by “Committee on Preschool Special Education” or “Committee on Special Education”
- Renewed/adjusted annually
- The major items to be included in an IEP:
  - The current levels of educational performance.
  - The annual service goals.
  - The specific special education and all related services to be provided to the child.
  - The projected date for initiation and anticipated duration of such services.
  - Appropriate objective criteria and evaluation procedures for assessment of the improvement of the child.
THE TRANSITION PROCESS FOR SECONDARY STUDENTS WITH DISABILITIES

- **Aim:** to prepare students with disabilities for post-school employment, community living and postsecondary education
- **When:** 14-21 yrs.
- **How:**
  - The school district Committee on Special Education (CSE) has the legal responsibility to coordinate transition planning
  - Needs the active participation of students, families and community agencies
  - Provides transition services through the Individualized Education Program (IEP)
SERVICES PROVIDED BY EDUCATIONAL AUDIOLOGIST

• 78% FM maintenance
• 76% In-service training to support personnel
• 75% FM fittings
• 72% Classroom strategies
• 68% IEP Planning and meetings
• 67% Diagnostic assessments
• 63% Serve on educational teams
• 62% Earmold modification and fitting
• 61% Family counseling
• 59% Hearing aid repair and trouble-shooting
• 55% Classroom functional assessments
• 52% Hearing screening
• 37% Hearing conservation education
• 33% Auditory processing evaluations
• 24% hearing aid fitting
• 18% others
ROLES OF SPEECH-LANGUAGE PATHOLOGISTS

- Evaluate the developmental stages of speech and language and communication abilities
- Provide speech and language intervention
  - Speech perception training, auditory training, speech reading
  - Speech production training
  - Sign language, cued speech, language therapy
- Provide training to parents and classroom teachers
- Advise audiologists about appropriate language levels for hearing tests
BREAK
(CENTRAL) AUDITORY PROCESSING DISORDERS (CAPD)

What we do with what we hear
WHAT IS (C)APD?

- (Central) auditory processing disorders (CAPD)
  - Auditory processing: the perceptual processing of auditory information in the CNS
  - Difficulties in the perceptual processing of auditory information in the CNS.

- The precise cause is unknown, but may be associated (comorbid) with conditions as varied as:
  - Developmental delays
  - Head trauma
  - Lead poisoning
  - Hyperbilirubinemia
  - Chronic ear infections
  - ADD/ADHD
SYMPTOMS OF APD

• Individual behaves as if has a hearing loss
  • E.g., says “what” frequently

• Auditory Discrimination Problems

• Auditory Memory Problems

• Auditory Attention Problems

• Auditory Cohesion Problems

• A decrease in auditory performance with competing acoustic signals

• Poor sound localization and lateralization
TESTS OF APD

- **Basic audiological tests:**
  - Central auditory processing tests used in UB clinic
    - Speech in noise test
    - Staggered Spondaic Word (SSW) Test
      - Assesses listener’s ability to comprehend words in complex listening conditions
    - Phonemic Synthesis Test
  - Temporal processing tests

- APD is diagnosed by audiologists.
MANAGEMENT OF APD

• Selection of service types depends on
  • the nature of the APD
  • the age of the child
  • the co-existence of other disabilities
  • the availability of resources

• Aims of AR
  • Improve the quality of the auditory signal
  • Improve the auditory perceptual skills (bottom-up)
  • Enhance the language and cognitive resources (top-down)

• Computer software (e.g. Earobics, Hear Builders, Fast ForWord)
# MANAGEMENT OF APD

## TABLE 9.7

<table>
<thead>
<tr>
<th>MANAGEMENT OF CENTRAL AUDITORY PROCESSING DISORDERS</th>
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</thead>
<tbody>
<tr>
<td><strong>FUNCTIONAL DEFICIT</strong></td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>Distractibility and inattention</td>
</tr>
<tr>
<td>Poor memory</td>
</tr>
<tr>
<td>Right hemisphere activation</td>
</tr>
<tr>
<td>External aids</td>
</tr>
<tr>
<td>Restricted vocabulary</td>
</tr>
<tr>
<td>Cognitive inflex: predominantly analytic or predominantly conceptual</td>
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</tbody>
</table>

*Source: Chermak and Musiek, 1992.*
## MANAGEMENTS OF APD

### Table 9.7
Management of Central Auditory Processing Disorders

<table>
<thead>
<tr>
<th>FUNCTIONAL DEFICIT</th>
<th>STRATEGIES</th>
<th>TECHNIQUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor listening comprehension</td>
<td>Induce formal schema to aid organization, integration, and prediction</td>
<td>Recognize and explain connectives (additives; causal; adversative; temporal) and patterns of parallelism and correlative pairs (not only/but also; neither/nor)</td>
</tr>
<tr>
<td></td>
<td>Maximize visual and auditory summation</td>
<td>Substitutions for notetaking</td>
</tr>
<tr>
<td>Reading, spelling, and listening problems</td>
<td>Enhance multisensory integration</td>
<td>Phonemic analysis and segmentation</td>
</tr>
<tr>
<td>Maladaptive behaviors (passive, hyperactive, impulsive)</td>
<td>Assertiveness and cognitive behavior modification</td>
<td>Self-control, self-monitoring, self-evaluation, self-instruction, problem solving</td>
</tr>
<tr>
<td>Poor motivation</td>
<td>Attribution retraining: internal locus of control</td>
<td>Failure confrontation, attribution to factors under control</td>
</tr>
</tbody>
</table>

*Source: Chermak and Musiek, 1992.*
ENVIRONMENTAL FACTORS
BASIC ACOUSTICS OF CLASSROOMS
CLASSROOM ACOUSTICS

• Three factors that affect classroom acoustics:
  1. Background noise
  2. Reverberation
  3. Distance
1. BACKGROUND NOISE

• Any undesirable noise that may affect listening
• **General levels of expected background noise**
  • A regular classroom: 60 dBA (A-weighted dB)
  • Gyms and cafeterias: 70-90 dBA
SIGNAL-TO-NOISE RATIO (S/N RATIO OR SNR)

• We’ve talked about this before
  • The difference between the desired signal and undesired noise (which interferes with hearing)

• Positive values are GOOD:
  • Indicates that the signal is louder than the noise
  • E.g. 3 dB S/N ratio

• Negative values are NOT GOOD:
  • Indicates the signal is softer than the noise
  • E.g., -2 dB S/N ratio

• A typical classroom: +6 dB s/n ratio
IMPACTS OF NOISE ON SPEECH PERCEPTION

• Children with hearing impairment or an APD are more susceptible to the influence of background noise

• Children with disorders not directly related to hearing issues also suffer from a poor S/R ratio...
  • ADD/ADHD
  • ODD
  • ASDs

• However, even with normal hearing children, a poor S/N ratio is extremely disadvantageous for learning
WAYS TO REDUCE CLASSROOM NOISE

• **Aim:**
  - Maintain the level of noise below 50 dBA
  - Improve the s/n ratio to +15 to +20 dB

• **Techniques:**
  - Use FM systems
  - Use carpeting, acoustical tile
  - Cover the bottom of chairs and desks with soft pads
  - Choose a classroom away from external noises
  - Keep windows and doors closed

• Clearly, not all of these techniques are either practical or even possible in all situations
2. REVERBERATION

- The persistence of sound in a particular space after the original sound is removed
- Both direct sound and reverberated sound reach the listener
- The reverberated sound interferes with listening to the direct sound.
ASSESSMENT OF REVERBERATION

• Reverberation time (RT):
  • The length time required for a sound to decay (decrease) by 60 dB SPL after the sound source is shut off
  • A parameter showing how long it takes for a sound to stop reflecting

• RT is determined by the absorptive properties of the reflecting surfaces and the distances between them (the room size).
ASSESSMENT OF REVERBERATION

• **Ideal reverberation time** is 0 seconds
• A **typical classroom** between: 0.5 and 1.5 seconds
• **Recommended reverberation time** for a classroom with *normal hearing children* is 0.5 seconds
• **Recommended reverberation time** for a classroom with *hearing impaired children* is around 0.3 seconds
EFFECTS OF REVERBERATION ON UNDERSTANDING SPEECH

• Interferes with the overall understanding of speech

• Reverberated vowel sounds interrupt the understanding of lower loudness consonants

• Silent intervals between syllables, sounds, and words are filled with reflected energy, and this results in a smearing effect of the sound
WAYS TO REDUCE REVERBERATION TIME

• Increase absorption
  • Replace or cover hard surfaces with softer ones to minimize the amount of reflection
    • Draperies
    • Carpet
    • Acoustic tile on ceiling
  • Reduce the size of a room
3. INFLUENCE OF DISTANCE

• Distance between the speaker and the listener is always an important factor in any communication situation.

• The greater the distance, the more difficult it is for the listener to receive the speech signals due to:
  • Decreasing loudness of speech signals
    • Reduction in sound intensity of 6dB with each doubling of distance between the speaker and listener
  • This in turn, reduces the S/N ratio
And now, a word from Jane Madell, PhD, and the Pediatric Audiology Project

https://www.youtube.com/watch?v=RBnvGKLF_Q