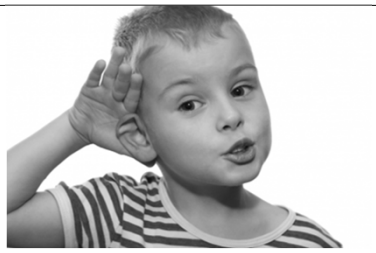
UNILATERAL HEARING LOSS IN CHILDREN: PROGRESS & OPPORTUNITIES

ANNE MARIE THARPE
CANADIAN ACADEMY OF AUDIOLOGY
NOVEMBER 2, 2022



1

Preview

I. Background

II. Outcomes

III. Current Management

IV. Moving Forward



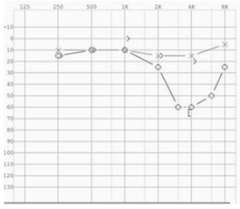
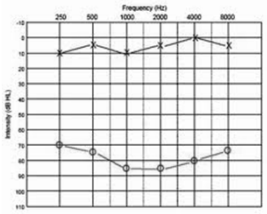

2

I. Background

3

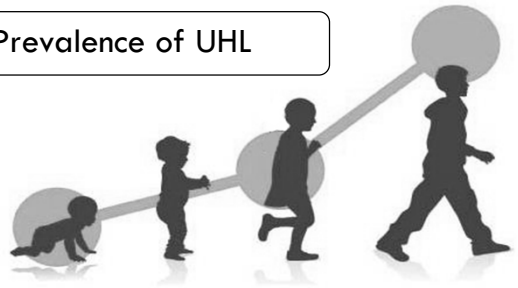
Definitions of Unilateral Hearing Loss

- Loss of any degree in one ear (Bess et al., 1986)
- Non-functional hearing in one ear: Single-Sided Deafness or Limited Usable Hearing Unilaterally (LUHU)

4

Prevalence of UHL



infants
.6-.7 per 1000

CDC, 2014

school-age
3-6 per 100

Bess et al., 1998
Shargorodsky, et al. 2010

adolescence
14 per 100

Shargorodsky, et al. 2010

5

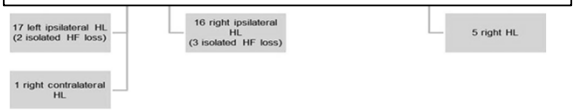
Causes of or Associated Factors with UHL

Association	Prevalence	Reference
Unknown/No risk factors	31-54%	Declau et al., 2008; Ghogomu et al., 2014
Cochlear nerve deficiency	26-50%	Clemmens et al., 2013; Nakano et al., 2013
Enlarged vestibular aquaduct	23%	Clemmens et al., 2013
Premature birth	20%	Haffey et al., 2013
Prolonged NICU stay	14-20%	Friedman et al., 2013; Haffey et al., 2013

6

Unilateral Enlarged Vestibular Aqueduct

Of children with severe-to-profound UHL who were imaged:
- 41% had abnormal temporal bone anatomy
- Most commonly EVA (14%)
- EVA most common bilaterally
- Those with unilateral EVA commonly progress to bilateral HL and >50% initially had UHL in ear without EVA



Greinwald et al., 2013

7

Paul et al., 2017; Haffey et al., 2013

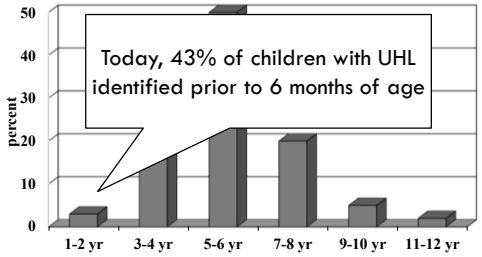
UHL progresses to bilateral hearing loss in 7.5 – 11% of patients

8

II. Outcomes

9

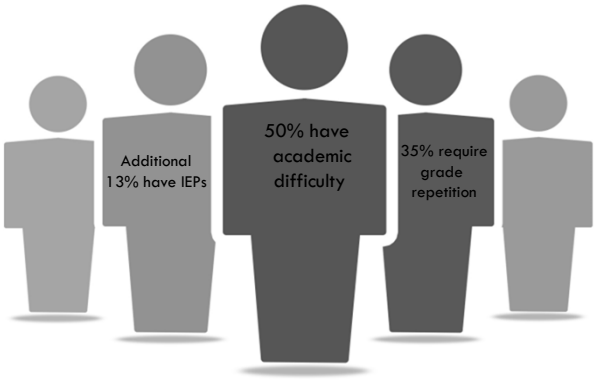
Age of Identification:



(Bess & Tharpe, 1986; Ghogomu et al., 2014)

10

Academic Outcomes Yesterday & Today



11

Effect of UHL on Infant and Toddler S/L Development

Cho Lieu (2004)

- Average age for first words = 12.7 months (WNL)
- Average age for first 2-word utterances = 23.5 months (significant delay)

Kishon-Rabin et al. (2015)

- 41% of infants showed delays in preverbal vocalizations

12

UHL and Speech-Language Scores
(Lieu, Tye-Murray, & Piccirillo, 2010)

- Sibling-controlled study of 6-12 y.o. with UHL
- n = 148
- Oral & Written Language Scales (OWLS)

Results:

- Children with UHL had poorer language comprehension, oral expression, and oral composite scores

13

Impact of Unilateral Conductive HL on Academic Performance
(Kesser, Krook, Gray, 2013)

- Case control survey
- School children with aural atresia
- None repeated a grade but 65% required resource help
- 47% had IEPs
- 45% received speech therapy

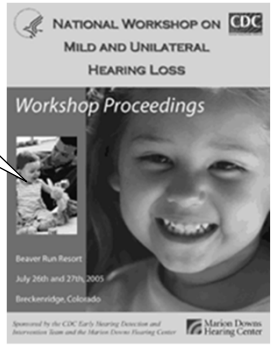
14

Centers for Disease Control & Prevention and the Marion Downs Hearing Center - 2005

But we still didn't know WHY these children were having trouble or WHAT to do about it

- Presented data on identification, assessment, & intervention
- Break-out groups for discussion
- Publication of proceedings

www.cdc.gov/ncbddd/ehdi/



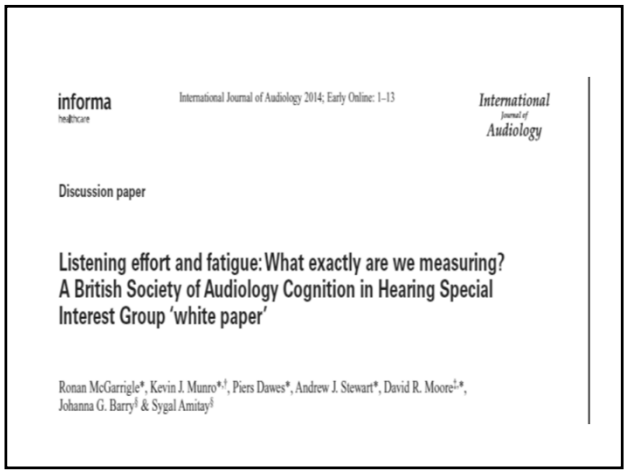
15

Listening Effort & Fatigue

16

Growing evidence of listening effort and fatigue in children with hearing loss

17

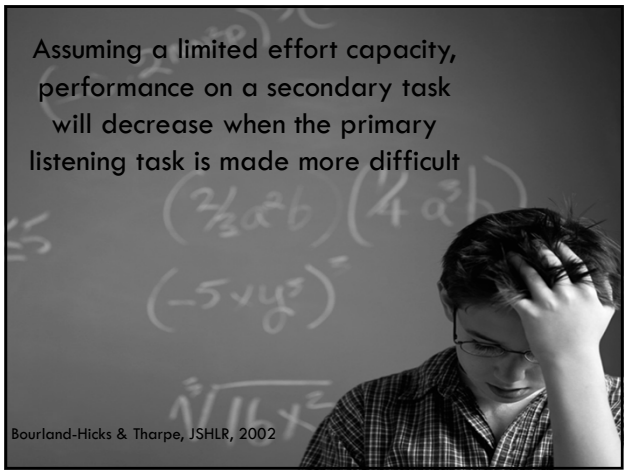

informa
healthcare
International Journal of Audiology 2014; Early Online: 1–13
International Journal of Audiology
Discussion paper

Listening effort and fatigue: What exactly are we measuring? A British Society of Audiology Cognition in Hearing Special Interest Group 'white paper'

Ronan McGarrigle*, Kevin J. Munro*,†, Piers Dawes*, Andrew J. Stewart*, David R. Moore‡,*, Johanna G. Barry§ & Sygal Amitay§

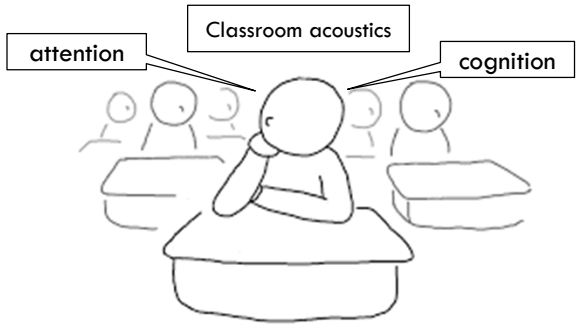
18

19



20

What does this mean for children in the real world? Depends…



21

Fatigue

No commonly accepted definition – Can be *physical* or *mental*, *subjective* or *objective* (Hornsby, Naylor, & Bess, 2016)

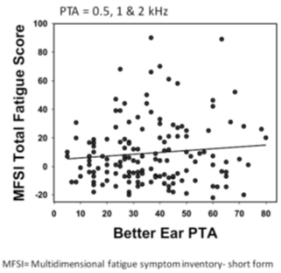
22

Consequences of ongoing, severe, fatigue

- Inattention
- Poor concentration
- Distractibility
- Poor school achievement
- High absenteeism

23

Degree of HL in adults and self-reported fatigue



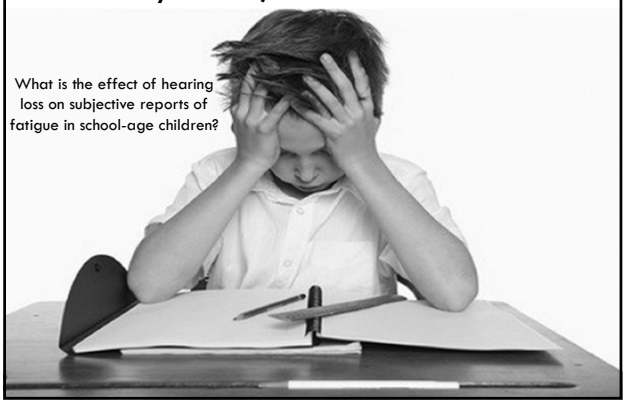
MFSI= Multidimensional fatigue symptom inventory- short form

- No association between degree of HL and fatigue
- Strong relationship between high levels of hearing handicap (HHIE/A) and subjective fatigue

(Hornsby & Kipp, 2016)

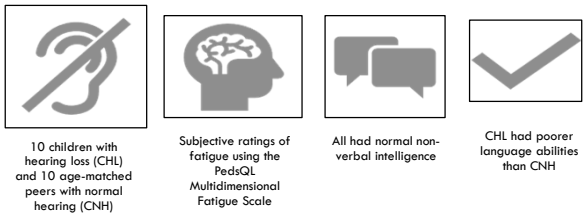
24

Hornsby et al., 2014



25

What they did…



10 children with hearing loss (CHL) and 10 age-matched peers with normal hearing (CNH)

Subjective ratings of fatigue using the PedsQL Multidimensional Fatigue Scale

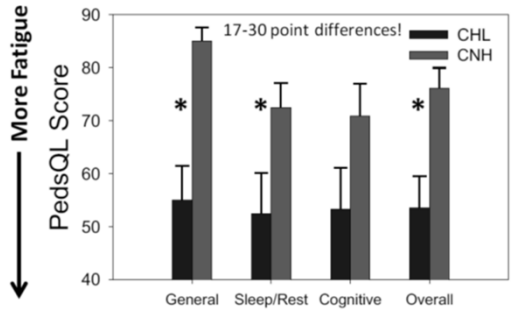
All had normal non-verbal intelligence

CHL had poorer language abilities than CNH

26

What they found…

PedsQL-MFS: Pediatric Quality of Life-Multidimensional Fatigue Scale (Varni et al., 2002)



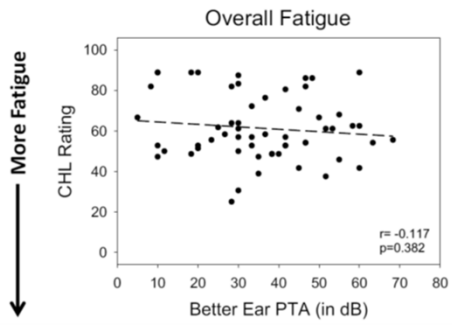
27

Why is this important?

The fatigue scores reported herein indicated more fatigue experienced by CHL than children with cancer, rheumatoid arthritis, diabetes, and obesity (Varni et. Al, 2002; 2004; 2009; 2010)

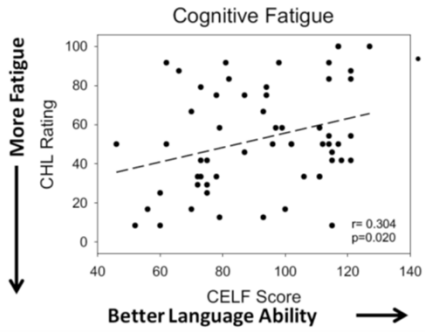
28

No association between fatigue ratings and degree of HL



29

Cognitive fatigue ratings are associated with language ability (CELF scores)



30

JSLHR

Research Article

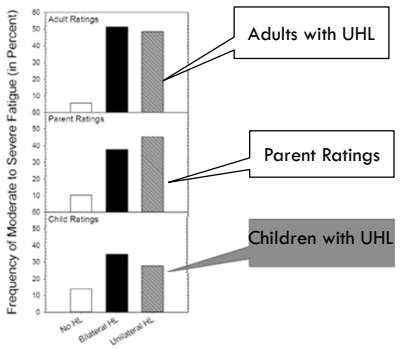
Development and Evaluation of Pediatric Versions of the Vanderbilt Fatigue Scale for Children With Hearing Loss

Benjamin W. Y. Hornsby,[a] Stephen Camarata,[a,b] Sun-Joo Cho,[b] Hilary Davis,[a] Ronan McGarrigle,[c] and Fred H. Bess[a]

The VFS-Peds provides a sensitive, reliable, and valid measure of listening-related fatigue in children for clinical use.

31

Listening-Related Fatigue in Children with UHL (Bess et al., 2020)



32

https://www.vumc.org/vfs/vanderbilt-fatigue-scales

Hornsby et al., 2022

33

34

Nap Benefits? Liu et al., Sleep, 2019 (bit.ly/nap-school)

- 3819 elementary school children (ages 10-12 yrs)
- Children who napped at midday for 30-60 mins at least 3x week:
  - Greater happiness
  - Better self-control
  - Higher verbal IQ
  - Higher academic achievement
  - Fewer behavioral problems when compared to non-napping peers

35

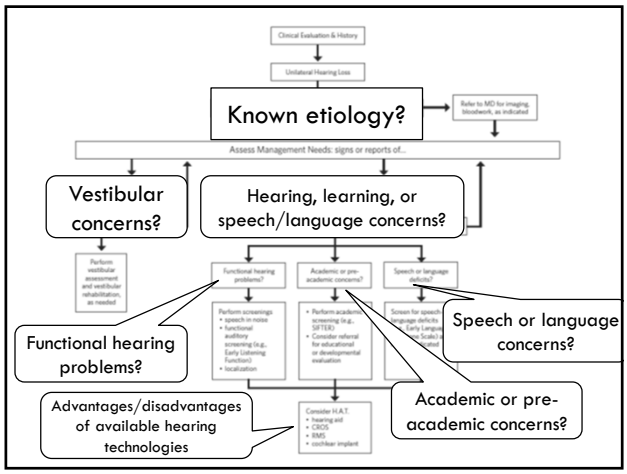
III. Management

36

Consensus Practice Parameter: Audiological Assessment and Management of Unilateral Hearing Loss in Children
(IJA, Bagatto et al., 2020)

- Identification and Audiologic Assessment and Monitoring
- Medical Management
- Technology Management
- Information Counseling for Families
- Priorities for Research

37

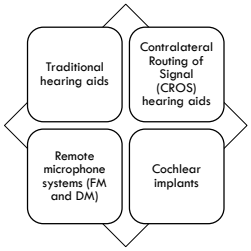


38

Tool	Target	Age
Early Language Milestone Scale-II	Receptive & expressive language	B-36 mos
Early Listening Function	Auditory detection	Infants & toddlers
Pre-School SIFTER	Classroom listening behavior	3 yrs to K
SIFTER	Classroom listening behavior	Grade school
Communication & Symbolic Behavior Scales	Language & symbolic development	Infants & toddlers

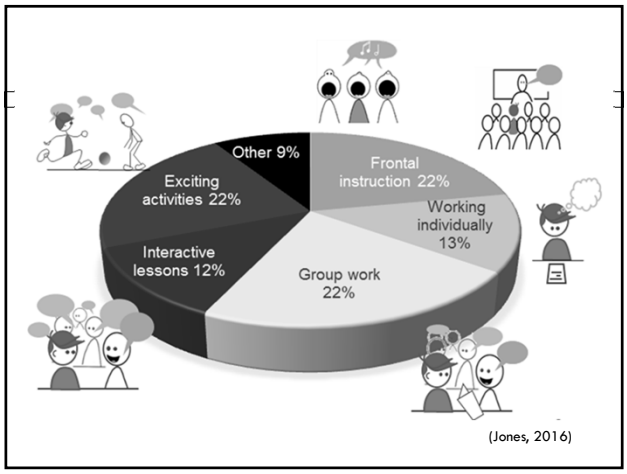
39

Hearing Technology Options for UHL



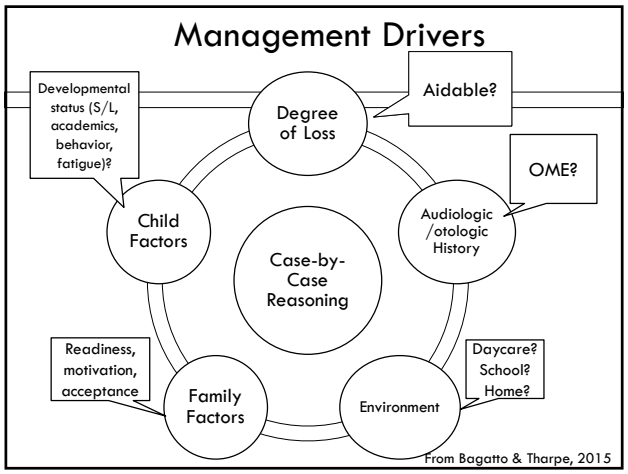
40

41

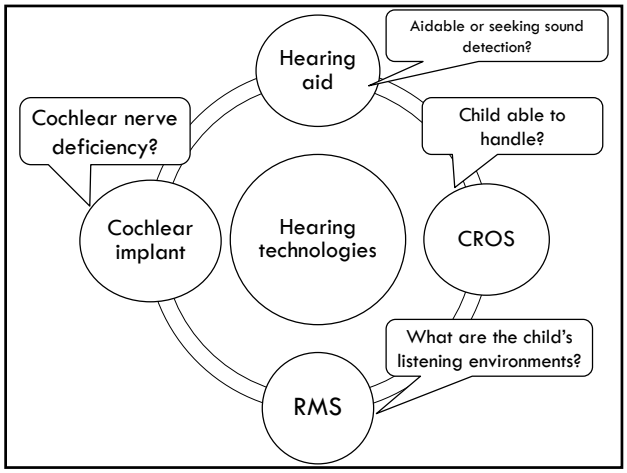


42

43



44



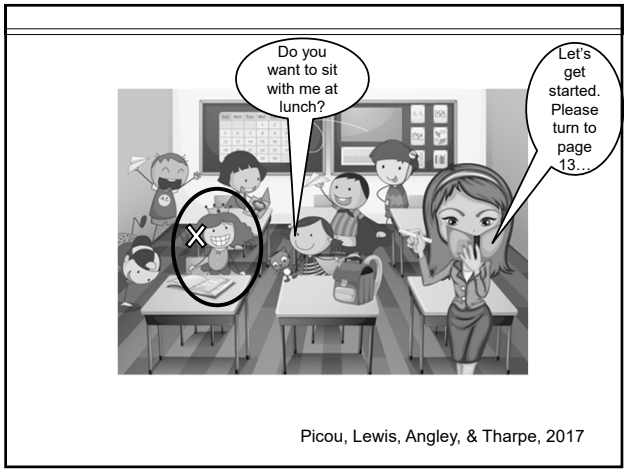
45

Unaidable Hearing

- Profound SNHL
- Very poor word recognition
- Marked intolerance for amplified sounds

(Valente et al., 2002)

46



47

Picou, Lewis, Angley, & Tharpe, 2017

- CROS has the potential to help children with unilateral hearing loss in modern classrooms
- Benefits most apparent for talkers on the "poor side"
- Benefits of CROS relative to an FM most notable in multi-talker situations with peers who are not using the remote microphone

48

IV. Moving Forward

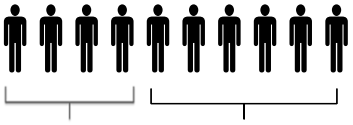
49

What we Know

- A significant portion of children with permanent UHL have been found to demonstrate difficulties observed
  - In academic settings
  - Under laboratory conditions
  - By parents and teachers
  - By the children themselves

50

What distinguishes



These children from these children?

51

What are the contributing stressors?

- Listening conditions?
- Listening effort and/or fatigue?
- Lack of early or aggressive intervention?
- Lack of effective amplification?
- Concomitant recurrent otitis media?
- Connectivity between brain networks involved in executive function, cognition, & language comprehension?
- Etiology?

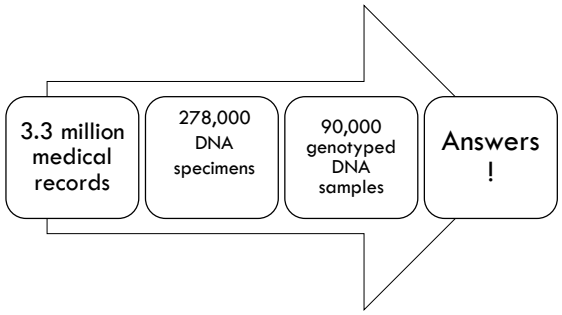
52

Vanderbilt Synthetic Derivative (SD) Database

- A de-identified copy of the main medical record databases created for research purposes
- De-identified through application of commercial electronic program to scrub identifiers
  - Names replaced with codes (e.g., NAMEAAA,BBB)
  - Dates such as "January 1, 2003" replaced with randomly generated date (e.g., "February 3, 2004)"
- The SD contains >3.3 million electronic records

53

Phenome-Wide Association Study (PheWAS)



Davis, Tang, Picou, Bastarache, & Tharpe, in review

54

We still have much to discover!

55