

LISTENING IS EXHAUSTING!

FATIGUE ASSOCIATED WITH HEARING LOSS

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The Big Picture for Children with HL

Self-determination

Academic progress

Language development

Hobbies/Extra-curriculars

Social relationships

Family members

Technology

Listening-Related Fatigue

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What is fatigue?

Having no energy

Exhaustion

Lethargic

May be physical, mental, or emotional

Lack of energy

Tiredness

Difficult to describe

Lack of strength

Weariness

Worn out

EXTREME TIREDSNESS

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Can we define fatigue?

Physical fatigue: reduced ability or desire to perform some physical task

Cognitive/mental fatigue: state of decreased optimal performance due to sustained cognitive demands

Measured behaviorally, physiologically, and subjectively

Boksem & Tops, 2008; Lieberman, 2007; Chalder et al., 1993; Hornsby et al., 2016

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Aren't we all fatigued?

Recurrent, severe fatigue

- **Uncommon** in healthy populations, but common in many chronic health conditions
 - Previous reports in individuals with cancer, HIV/AIDs, Parkinson's, Multiple Sclerosis
 - Very little work looking at fatigue and hearing loss, especially for children

Eddy & Cruz, 2007; Fletcher & Bottomley, 2003; Cullen et al., 2002

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Who is at risk for fatigue?

- 18-38% of adults
- 4% of children and adolescents
- Higher rates following puberty
- More common in females
- More common in lower socioeconomic groups
- More severe in those with **chronic conditions**

Hearing loss?

Engberg et al., 2017; Cullen et al., 2002; Gordijn et al., 2011

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Negative Consequences of Fatigue in Adults

- Reduced efficiency at work
- Accidents in the workplace
- Decline in attention
- Impaired judgement
- Slowed reaction time
- Decline in motivation
- Association with depression
- Mental distress

NEGATIVE EFFECTS ON QUALITY OF LIFE




Kramer et al., 2006; Nachtegaal et al., 2012

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Negative Consequences of Fatigue in Children

- Reduced academic performance
- Increased school absences
- Inability to engage in usual daily activities
- Sleep disturbances
- Changes in social relationships



Curcio, Ferrara & De Gennaro, 2006; Nagano, 2004; Stoff, Bacon & White, 1989

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What is listening-related fatigue?




It's like doing **Jigsaws, Sudoku, and Scrabble** all at the same time."

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Fatigue in Adults with HL

- Difficulty understanding
- Increased attention, concentration and effort at work
- Increased stress, tension and fatigue
 - **"too tired for normal activities"**
- Rate of sick leave for AHL four times greater due to burnout
- Self-rating of productivity decreased



Hetu et al., 1988; Kramer et al., 2008

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Is fatigue a problem for children with hearing loss?


- Taxonomy of Fatigue Concepts and Their Relationship to HL (Hornsby et al., 2016)
- CHL have **elevated levels of cortisol upon awakening**, indicating a possible dysregulation in HPA axis activity. This pattern is associated with **burnout** in adults. (Bess et al., 2015)
- CHL demonstrate **reductions in attentional processing of SIN following sustained speech-processing tasks** measured by auditory P300 responses, subjective reports, and behavioral indices. (Gustafson et al., 2018)
- Those with **poor reading skills** reported significantly **higher levels of subjective fatigue** compared to other children with HL in the study. (Camarata et al., 2018)

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What is listening effort?

The allocation of attentional and cognitive resources toward auditory tasks.

- CHL and AHL must increase mental effort compared to those without HL when attempting to detect, process, and respond to auditory stimuli
 - Increase in **LISTENING EFFORT**
 - Increase in **FATIGUE?**



Alhanbani et al., 2017; Hicks & Thorpe, 2002; McGarrigle et al., 2014

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Does effortful listening affect CHL? "Effortfulness Hypothesis"

EFFORTFUL LISTENING IN DIFFICULT SITUATION

COGNITIVE RESOURCES

RESOURCES LEFT FOR OTHER PROCESSING NEEDS (memorization, comprehension)

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Classroom Listening

Fran had a sore throat. She loved to jump on lily pads and twilight and morning were the best times for her to eat. It made her happy to get big juicy files. But it hurt Fran to croak.

Karen Anderson, Success for Children with Hearing Loss

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What contributes to listening-related fatigue?

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    graph LR
      A[Listening in the classroom] --> B[Increased listening effort]
      B --> C[Decline in top-down processing resources]
      C --> D[Stress]
      D --> E[Fatigue]
      E --> A
  
```

Bess & Hornsby, 2013

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    graph LR
      A[Listening in the classroom] --> B[Increased listening effort]
      B --> C[Decline in top-down processing resources]
      C --> D[Stress]
      D --> E[Fatigue]
      E --> F[Degraded cognitive processing]
      F --> G[Disengagement]
      G --> H[Learning skills affected]
      H --> I[Decline in school performance]
      I --> A
  
```

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Subjective Measures of Fatigue

- Numerous measures looking at fatigue and energy in various clinical populations
 - The Fatigue Questionnaire
 - Fatigue Assessment Scale
 - Chalder Fatigue Scale
 - POMS

	NEVER	SOMETIMES	REGULARLY	OFTEN	ALWAYS
I am bothered by fatigue					
I get tired very quickly					

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Fatigue and Vigor in AHL

- n=149 (59% males)
- Mean age of 66.1 years (range: 22 to 94 years)
- 92% SNHL

■ Profile of Mood States (POMS; McNair et al., 1971)

	Not at all	A little	Moderately	Quite a bit	Extremely
Worn out					
On-edge					

■ Multidimensional Fatigue Symptom Inventory-Short Form (MFSI-SF; Stein et al. 2004)

	Not at all	A little	Moderately	Quite a bit	Extremely
I feel refreshed					
My head feels heavy					

Hornsby & Kipp, 2016

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Fatigue and Vigor in AHL

■ AHL were more than **twice as likely to report severe fatigue**

■ AHL were more than **four times as likely to report severe problems with vigor**

■ No association with degree of HL, but did see association with self-perceived hearing handicap (HHIE)

• Also see Alhabani et al., 2017

Hornsby & Kipp, 2016

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Subjective Fatigue in CHL

PedsQL Multidimensional Fatigue Scale

In the past ONE month, how much of a problem has this been for you...

Subscale	Item	Never	Almost Never	Sometimes	Often	Almost Always
General	I feel tired	0	1	2	3	4
Sleep/Rest	I sleep a lot	0	1	2	3	4
Cognitive	It is hard for me to keep my attention on things	0	1	2	3	4

8-12 year old version

SCORES: General, Sleep/Rest, Cognitive and Overall Varni et al., 2002

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- 60 CHL (59 HA users)
- 43 CNHL
- Age 6-12
- Self and parent report

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Subjective Fatigue in CHL

Figure 2. Mean Pediatric Quality of Life Inventory Multidimensional Fatigue Scale (PedsQL-MFS) scores for the hearing loss (HL) and normal hearing (NH) groups, collapsed across respondent type (parent-proxy and child). Lower values reflect more fatigue. Open and dashed bars reflect HL and NH group responses, respectively. Asterisks show significant between-groups differences ($p < .05$).

Significant association between COGNITIVE fatigue score and:

- Language abilities
- Poorer language = higher levels of fatigue
- See Werfel and Hendricks, 2016 (children with CI)

Hornsby, 2016; Hornsby et al., 2017

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CHL reported more, or similar, fatigue across multiple domains when compared to other control groups AND children with other chronic conditions

Hornsby et al., 2017

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Listening-Related Fatigue Scales

- Vanderbilt Fatigue Scale-AHL (Adults with Hearing Loss)
- Vanderbilt Fatigue Scale-CHL (Children with Hearing Loss)
 - Pediatric Version
 - Caregiver Version
 - Teacher/Service Provider Version

GOAL: create and validate a measure of fatigue in individuals with hearing loss and other communication difficulties with specific listening-related questions.

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Phase 1: Focus Groups

PARTICIPANT TYPE	NUMBER
Adults with hearing loss (AHL)	42
Children with hearing loss (CHL)	39
Parents of CHL	17
Teachers of CHL	28



How often do you feel physically or emotionally tired due to difficulty listening?

Is fatigue from listening a problem for your student/child?

What coping strategies do you/the student use to recover from fatigue?

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"Yesterday, we took a field trip to a museum. The gentleman was great, but he spoke so fast—she was still missing stuff. In a very hectic environment..., I can tell it's a lot for her. She has to make an effort, and it wears her out."

-parent of 10 year old with bilateral hearing loss



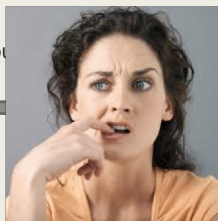
"Yeah, **you wanna give up.** You just don't want to try anymore because you know you won't actually get what they're trying to say or sometimes you think it's just you. Maybe I need to try a little harder to listen but when you do try, you **put all of your focus on what they're trying to say and you still can't hear them.**"

-teen with bilateral hearing loss and hearing aids



Phase 1: Defining the Issues-CHL

"Fatigue so... maybe a squid?"



reports? and/or parent proxy

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"Yeah, **you wanna give up.** You just don't want to try anymore because you know you won't actually get what they're trying to say or sometimes you think it's just you. Maybe I need to try a little harder to listen but when you do try, you **put all of your focus on what they're trying to say and you still can't hear them.**"

-teen with bilateral hearing loss and hearing aids



I want to give up when I have difficulty understanding what someone is saying.

Vanderbilt Fatigue Scale Questions

TEACHER Never Rarely Sometimes Often Almost Always
 My student stops participating in difficult listening situations.

PARENT Never Rarely Sometimes Often Almost Always
 Trying to keep up in a conversation exhausts my child.

CHILD Never Rarely Sometimes Often Almost Always
 I use a lot of energy trying to understand what others are saying.

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Who reports listening-related fatigue on the VFS-CHL?

- Gender
- Age
- Hearing loss status
- Degree of hearing loss
- Amplification
- Additional disability
- Maternal education
- Type of intervention at school (504, IEP)

N= 399 parents, 363 teachers, 151 children

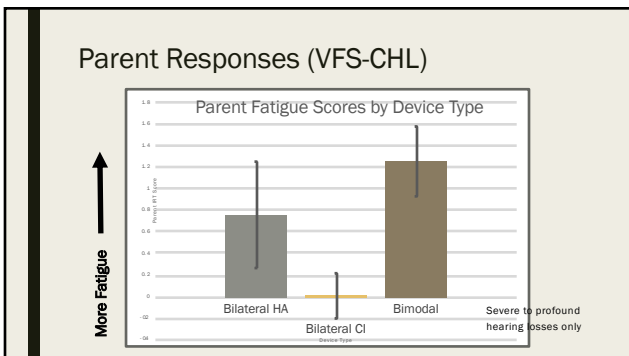
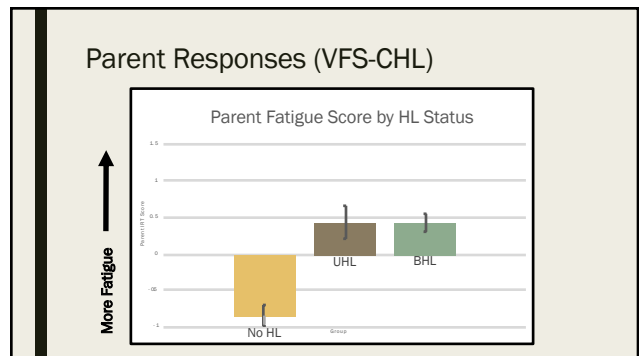
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NO DIFFERENCES

- Child gender
- Child age
- Maternal education
- Degree of HL

TAKE AWAY

- Boys and girls
- Elementary through high school
- Children of all SES
- Children with all degrees of HL



Additional Disabilities

- Cognitive Disability
- Visual Impairment
- Behavioral/Emotional Problem ★
- Physical disability
- Speech-Language Impairment ★
- Genetic/Chromosomal Syndrome

Trend toward differences between 0, 1, or more than 1 additional disabilities resulting in higher levels of subjective fatigue.

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NO DIFFERENCES

FUTURE WORK

- Hearing loss status (child)
- Hearing loss status (teacher)
- Child bad reporter? Understand concept?
- Teacher type? Teacher comparing to other peers with HL or typical hearing peers?

Highlights of VFS-CHL Data



- Subjective listening related fatigue not impacted by:
 - Age
 - Gender
 - Degree of hearing loss
 - Maternal education
- Differences noted for:
 - Additional disabilities
 - Amplification (severe to profound HL)



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Limitations of VFS-CHL Data

- No systematic differences in child reports
 - Children bad reporters?
 - Children understand concept?
- Teacher reports
 - Type of teacher
 - Frequency of observation
- Proxy reports
 - Previous literature shows that proxy reports are not always accurate for internalized behaviors/feelings

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Future Directions

- Additional data collection with subjective measures:
 - Teacher comparison data
 - Other communication difficulties
 - Younger children
- Following identification of fatigue, what **intervention** is systematically available?
 - "Listening break (2 minutes in duration) every hour to avoid fatigue."
 - "FM systems help with fatigue."

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Implications for Practice

Fatigue can manifest itself in a variety of ways:

- tiredness
- sleepiness in the morning
- inattentiveness and distractibility
- mood changes (irritability, frustration, etc.)
- changes in classroom contributions
- difficulty following instructions



Talk to your patients and their families about listening-related fatigue.

Be on the lookout for the VFS-CHL soon!

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Suggestions for Intervention

SCHOOL ACCOMMODATIONS/MODIFICATIONS
Provide notes ahead of class time to reduce need to multi-task during lecture/discussion
Provide a space and/or scheduled break time for listening/quiet breaks
Consider schedule of day and timing of auditory tasks, including therapies or other pull-out sessions
Consistent personal amplification and FM/RM system use
Preferential seating to potentially reduce listening effort
Visual information available in the classroom
Classroom acoustic modifications

No systematic interventions have been studied...YET!

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Take Home Messages

- CHL are at increased risk for listening-related fatigue
- It is not simple to predict who may be affected; however, those with **additional disabilities** and **poorer language abilities** may show more problems with LRF.
- Systematic review of intervention strategies are necessary
 - *Common sense interventions*
- Make your patients, their parents, and educators aware of fatigue!

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Big Picture for Children with HL

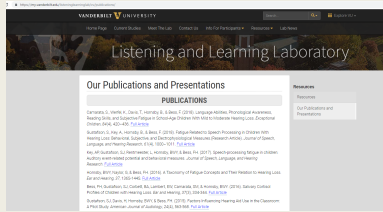
- How can audiologists:
 - *better understand and find ways to counteract the factors underlying why listeners may decide to quit participating in activities because it takes too much effort to listen*
 - *help listeners to strategically employ their available cognitive capacity in situations when it is hard to listen?*
 - *prevent listeners from avoiding situations and withdrawing from social participation because it is too hard to listen?*

THINK BEYOND THE AUDIOGRAM!

Pichora-Fuller et al., 2016

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Listening and Learning Lab Presentations and Publications



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Food for Thought



- Have your patients reported listening-related fatigue? What symptoms do they report?
- What are strategies that you have recommended?

Questions? Comments?



Visit the Listening and Learning Lab's website at
<http://my.vanderbilt.edu/listeninglearninglab>

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Parent + Child Comparisons

